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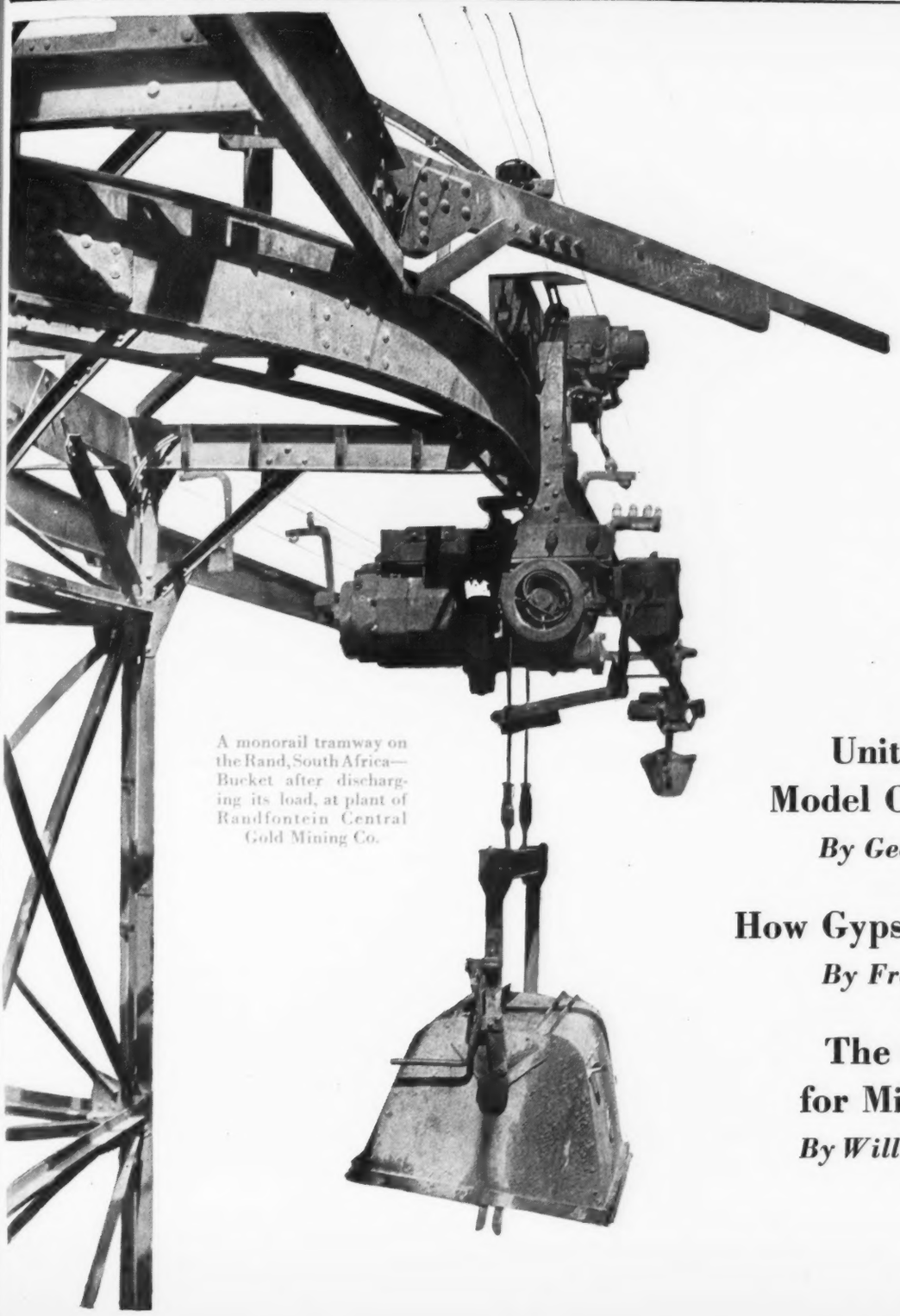

A monorail tramway on the Rand, South Africa—Bucket after discharging its load, at plant of Randfontein Central Gold Mining Co.

United Verde's Model Crushing Plant

By George J. Young

How Gypsum Is Marketed

By Frank A. Wilder

The Cost Sheet for Mine Foremen

By William F. Boericke

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

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The Proper Way To Raise the Price of Copper

IN THE midst of a lot of loose talk about the necessity of a tariff on copper, at least two large producers have decided on a policy which, if generally followed, cannot but help raising the price and in strict accordance with economic fundamentals. Both Calumet & Hecla and Inspiration have decided on the five-day week, which, presumably will reduce their production by one-sixth. The combined production of these companies is about 15,000,000 lb. of copper monthly, so that the one-day-a-week shutdown will only represent about a 2,500,000 lb. decrease; but it is to be hoped that the example will be followed by others. If every producer would take this step there is no doubt that the price of copper would rise to a figure which would give a fair profit to most of the producers. Of course, there is less incentive to curtail production for those companies which are now producing copper at around 10c per pound; but even these would, we feel sure, find it to their ultimate advantage to do so.

Our readers well know that there is nothing wrong with copper consumption; neither is production much too great, but there is a general feeling in the trade that there is not the slightest chance of any particular shortage in supplies, and a slight advance in price has been all that is necessary to scare them out of the market. The more open market for export sales which has resulted from the withdrawal of certain companies from the Copper Export Association already has taken some pressure off the market; these opening guns of a policy of curtailed production should also help materially. We hope that more companies will follow suit.

Applications of the Zonal Theory

THE ZONAL THEORY of ore deposition has attracted much attention lately. Originally proposed in 1907, evidence supporting the soundness of it has been accumulating, and within the last few years there has been a general tendency not only to take it as proven, but to seek immediately practical applications of it. Conceived and proposed by Spurr in 1907 (and re-presented in 1908, 1912, and 1923), evidence illustrating the principle has since been put forward by many geologists, including Sales, Lindgren and Loughlin, Billingsley and Grimes, Butler, DeLaunay, Maclaren, Jones, and others; and the original explanation has recently been emphasized and approved by such writers as Kemp, Rastall, and Emmons. Briefly, this theory states that an original magmatic residue, or ore-magma in depth, may contain several or many metals; that as this ore-magma ascends and cools, the different metals are successively dropped as cooler regions are reached, so that under regular and ideal conditions veins containing a given metal overlie those containing another and in turn underlie veins of still another metal.

A typical simplified succession, as ideally constructed from many fragments of field evidence, is (from the bottom up): 1, non-metalliferous pegmatites; 2, tungsten ores; 3, gold; 4, copper; 5, zinc; 6, lead; 7, silver; 8, barren veins of quartz, calcite and other earthy minerals. The exact succession varies in different regions, depending on the local metallic content of the magmatic provinces. The truth of this general statement has been pretty well demonstrated, as above indicated, by fragmentary evidence. Lead ores have been found to pass downward into zinc ores; zinc ores to copper ores; silver ores to lead ores; gold ores to tungsten ores, and so on. Nowhere is the whole succession shown. In the first place, mining does not go deep enough in our day. Where the metal zones are best developed, it is certain that the whole succession occupies a vertical range of several miles.

The height of each zone of metal deposition will evidently depend on the vertical spacing of heat increment (isogeotherms) at the time of ore injection, since it is the fall in temperature which induces successive deposition of different metals. Where the fall of temperature, going upward, has been rapid, there and in those districts we note marked vertical changes in mining downward: and in such cases the understanding of the Zonal Theory will enable more intelligent development and planning, and will therefore yield economic and practical results. On the other hand, in many districts the record shows that the decrease of temperature upward must have been gradual during ore deposition, and accordingly the individual metal zones are extensive in a vertical sense: and in such regions the vertical distances to be traversed are usually too great for economic mining exploration based upon the expectations aroused by these principles. Such is the case ordinarily with ores which have crystallized at great depths, such as the gold-quartz zone. Passing to the other extreme, the record shows that in some cases the decrease in temperature upward has been very rapid, so that the typical metal zones succeed each other within a relatively short vertical space, or even overlap and are "telescoped" together. Thus, we have, so very commonly, zinc-lead ores, or gold-copper ores, or even copper-zinc-lead ores, or gold-copper-zinc ores, and the like—constituting some of the complex ores which puzzle the metallurgist.

There are many other complications besides those noted above: so that the planning of development work based upon these considerations should only be undertaken with the most expert geological advice, which must first investigate and take full account of local conditions.

Difficulties of Large Precious Metal Enterprises

OPERATIONS of the United Comstock mines at Gold Hill, Nev., afford an interesting and instructive insight into the difficulties that attend the initiation and operation of properties where success is predicated on relatively large scale enterprises. In

this instance the original plan, to the best of our information, was to mine and mill 1,000 tons per day. The estimated tonnage, according to current gossip, would have thus permitted about seven years' life. The ore values in the old stope fills and remnants of the orebody were low, and low operating costs were essential to success. However, plans were changed to accord with an output of 2,000 tons per day. This was undoubtedly due in part to the desire of taking advantage of the Pittman silver price. A long adit was started and the construction of an elaborate milling plant and other accessories was begun. Although the essential conditions of the economic problem involved a minimum capital input and rapid construction, these factors appear to have been overlooked and as a result the expenditures assumed surprising proportions, somewhere near $5,000,000, according to report, or a capital charge of about $2.50 per ton of estimated ore.

The mill was finished somewhere near schedule time, but mine development on a scale commensurate with the daily output was insufficient. The mine failed to supply the requisite tonnage. Attempts to glory-hole resulted in the dilution of ore values and milling difficulties, due to the clayey character of the near-surface material sent to the mill. Loose management and inexperience undoubtedly contributed to the initial difficulties. All large enterprises encounter difficulties at the start and an operating organization is not formed over night but takes an appreciable time to develop. Unfortunately, before the operation was whipped into shape, the Pittman price of silver became history and the enterprise was down to bedrock. Little advantage was gained by Pittman silver.

Fundamental changes of personnel were made and the new men in charge were given a difficult problem. It is reported that they have improved the existing conditions. Whether the enterprise will redeem itself remains to be seen. Much depends upon the increase in reserves by additional development. Much also depends upon the success of existing mining methods in maintaining an ore grade approaching the estimated grade. Necessity compels operation somewhere around 2,000 tons per day and at this rate it is possible that a fair operating profit can be made; but whether the amount of money already spent can be recovered is rather more than doubtful. Like the Alaska Juneau, the problem of salvaging anything is first and foremost. The United Comstock, according to their bullion statement, made an operating loss for the last quarter of 1923, of $7,626.98, on 128,877 tons mined and milled, of an average assay value of $3.651 per ton.

The history of the United Comstock to date is of importance to mining men in that it emphasizes the need for conservative thinking and business acumen at the start of an enterprise and the value of experienced, well-trained managers. Furthermore, the experience at Gold Hill points out the difficulties of reopening old mines. There is opportunity in this direction for future mining, but such projects are usually of limited life and require to be established on sound business principles as does any other mining project. When one considers the United Comstock failure, that of the great promotion of Alaska Gastineau, which Mr. D. C. Jackling is said to have called his "imbecile child," and the heroic struggle of Alaska Juneau to keep above water, one is impressed with the uncertainty of low-grade gold and silver mining and the necessity of a fair margin of safety over the ideal calculations of the promoters.

Metallurgy, Economics and Gold Output

ALASKA JUNEAU has announced an operating profit for January of $38,050, from the recovery of gold valued at under 70c. per ton of ore mined. This is the outcome of persistent effort to demonstrate the soundness of a program that included (1) large tonnage operations; (2) maximum discard of waste before milling commenced; (3) the concentration of the gold in a small bulk of concentrates and (4) its recovery by simple means. Low mining costs (24.72c. per ton) are possible because of the avoidance of the expense of intensive selective mining, necessary in many other properties because a complicated scheme of treatment involves heavy expense in maintaining the grade of the ore sent to the mill. Low milling costs (28.19c. per ton) are due to the avoidance of unnecessary crushing and grinding, and the adoption of a method of recovery that is economical as well as effective. It is expected that the output of the mine will be increased to about 10,000 tons per day, whereby the yield from the property will aggregate over $2,500,000 per annum.

The work at the Alaska Juneau, which reflects credit on its sponsors for their technical skill as well as for their persistence in following plans to a successful consummation in spite of pessimistic criticism, is the first indication of the wisdom, where conditions are favorable, of a reversion to simple treatment principles in the metallurgy of gold. Sorting, concentration and amalgamation have proved efficient and economical at the Alaska Juneau. It is not unlikely that the next step in an effort to increase the output of gold will be to borrow back from the copper industry the large-scale bulk leaching methods that have proved to be eminently successful at Chuquicamata, Ajo and in other mining camps.

The declining output of gold is not entirely a question for the consideration of economists. More ambitious metallurgical methods and, in some instances, a disregard of up-to-date practice may prove a satisfactory corrective to the decreasing output from high-grade ore, the known amount of which in the United States is decreasing rapidly.

Public Honesty

HOW DIFFICULT it is for the average citizen to make head or tail out of the hysterical clamor that comes out of Washington regarding the oil investigations! There is some fire there, as we have pointed out, but it is mostly smoke. Back of the investigation stands out a partisan attitude on the part of the investigators; and a prime purpose of discrediting the administration, regardless of the method that is employed.

The United States, in common with the rest of the world, has suffered a great loss of morale through the World War. What we believed would elevate our sentiments through the noble ardor of self-sacrifice has turned out to have dulled our finer perceptions. We do not need to instance the increase of crime, or the insidious popular rebellion against the Prohibition Amendment, which makes law-breaking too general to be startling.

The whole world is organized on an economic basis; business and profit are the gods we worship. Our tendencies are reflected in the representatives we send to Washington. Nowhere more than in the clamorous and unreliable Congress are these characteristics better

exhibited. The Senate is full of characters who do not hold the public esteem, who are patently windy demagogues and worse. On a recent visit to the press gallery we listened to the oratory and tactics of some of these men. One Senator, in particular, who orated, could be described only as a buffoon. Gross, uncultured, spiteful, unfair, he occupied the golden time of the country's government with a speech so childishly personal that if delivered on the vaudeville stage it would have won roars of laughter and been accepted as a parody. In the Executive department of the Government things can certainly be improved; but, in the Senate, conditions are desperate when the affairs of the nation and the world are neglected for partisan wrangling by the members of that house of Congress, and the grinding of private axes.

Roosevelt, preaching his restated decalogue, wrought a purification in popular ethics and in the government. There has been a progressive downward tendency since. Wilson's administration was more narrowly partisan and political than any since before the time of Cleveland. More offices were assigned as political spoils than ever before. Almost alone of all the great leaders of the war he did not attempt any coalition of parties, but made the war a Democratic affair. Harding brought with him a host of political debts and political debtors, who were introduced into offices from which the Democrats were dislodged. From the wind thus sown some of the whirlwind is being reaped. What fire there is in the Teapot Dome illumination is of the same order, if on a larger scale, as that of other slippery events.

No case that has come under our notice has shown up so strongly the general lack of honesty, in the people and in the government, as the details of carrying out the War Minerals Relief Fund. Rich men who had failed in their plan to profiteer in mining during the war, swore falsely in their claims as to the cause of their enterprise and collected separately claims each running up into hundreds of thousands of dollars. Some of them hired lawyers as unscrupulous as themselves, so that no avenue should be overlooked. But the best combination to rob the government under the hypocritical cloak of patriotism was to add politics to the guns brought to bear upon the people's Treasury. Senators and Representatives added their pressure at the behest of their wealthy constituents, and called up the Secretary's office to tell him that they expected he would treat their client right—otherwise they should remember it as a lack of political friendship. After Secretary Fall had dismissed the original commission of three—honest men—he appointed a politician to the office of Commissioner to take the place of the three. This man did not pretend to investigate his job; he did not want to be bothered by it. He expected his assistants to do the work, and they did.

And, long before that, even during the war, which we were fighting for self-preservation, Senators—including Democratic Senators—were exerting their full pressure behind clients who were seeking to get their hooks into the war treasury of the United States. When treachery is talked about, we think of these cases, and our blood boils—not with a special fire brought about by the crafty effort of one set of politicians to besmear another set, but by betrayal of the public trust, by government officials or private grafters, wherever it occurs. We have our full share of the last-named group in the mining industries.

Ideals of Technical Journalism

REAL PROGRESS is impossible without adherence to certain fundamental principles of judgment and without a recognition of the value of the idealistic aim. This is particularly true in technical journalism, which, based as it is on a scientific appraisal of theories, facts and figures, scorns sensationalism and political partiality, and discourages bias that indicates a tendency toward the powerful influence of aggregated capital. Fairness in weighing evidence, open-mindedness in seeing that no pertinent facts are excluded as evidence, and the cultivation of an inspiring and broadening spirit of fellowship with all workers in the same field should go far in encouraging research, fostering ambition and preserving amity among those who are striving for the common goal—efficiency and economy in the application of science to industry, in the art of winning Nature's treasures without undue wastage of reserves or capital.

Technical journalism would be non-existent today had powerful influence been exerted and maintained against the publication of the results of research and improvement. Stagnation would have been inevitable if personal motives had been allowed to prevail in keeping secret the progress made in adding, brick by brick, to the great edifice of technical achievement. And chaos and waste and disorganization would have followed if technical journalism had supported the pretended claims of the alchemist working in secret rather than encouraged the achievements of the scientist working in the open.

The obligation of every worker in the field of technical advance toward his predecessors and contemporaries is such that we are inclined to believe that secrecy usually spells meanness and connotes ignorance. Had it not been for the freedom with which the inventor could consult technical journals, to find out what had been done already, in few instances could he have known to what extent his work was original. It is a sad commentary on modern methods that publicity and credit, as post-mortem appreciations, often indicate the sum total of recognition and reward. It is the privilege of technical journalism to encourage the inventor who recognizes his obligations by frank publication, and to discourage the secret worker, who discourteously grabs and utilizes as a foundation the labor of others on which to build his own puny edifice of discovery.

Technical journalism has played an important rôle in modern life. It has been largely responsible for the encouragement of the scientific attitude and for a recognition of the benefits that result from research. The collapse of technical journalism would mean that a few editors would be out of jobs. This tragedy, however, would be insignificant compared to the blow that would be dealt to progress by a relapse into the ignorance and secrecy of medievalism. Furthermore, editors of technical journals, for the most part, are engineers by training and experience, who would soon find their places in the great scheme of technical progress. The loss, therefore, would fall entirely on those who now benefit from a practice of the ideals of technical journalism—(1) consideration of the group as well as the individual; (2) recognition of an achievement rather than the payment of tribute to wealth and power, and (3) the encouragement of that sense of fair play that springs from a realization that secrecy, often a cloak for ignorance or financial exploitation, is inimical to progress.

United Verde Completes Model Crushing Plant

Jaw, Disk and Roll Crushers Reduce Run-of-Mine Ore to Quarter-Inch—Dust-collecting System a Feature

By George J. Young
Associate Editor

THE NEW CRUSHING plant of the United Verde Copper Co. at Clarksdale, Ariz., just completed, is to supplant the crushing equipment at the mouth of the Hopewell tunnel. It is designed to receive the mine-run or both from underground operations and the steam-shovel workings and to crush to various sizes, ranging from a maximum of 2½ to 3½ in. to and through a ¼-in. screen. The crushed product is to be mechanically distributed to the coarse-ore bins, fine-ore bins, or to a stockpile. Mechanical reclamation is to be used for the stockpiles and the fine ore is delivered to the roasting-furnace bins by conveyors and elevators. From the roasters the fine-ore charge is handled by charge cars to the reverberatories and the coarse ore is delivered from the coarse-ore bins to the blast furnaces by side-tipping cars of the Anaconda type.

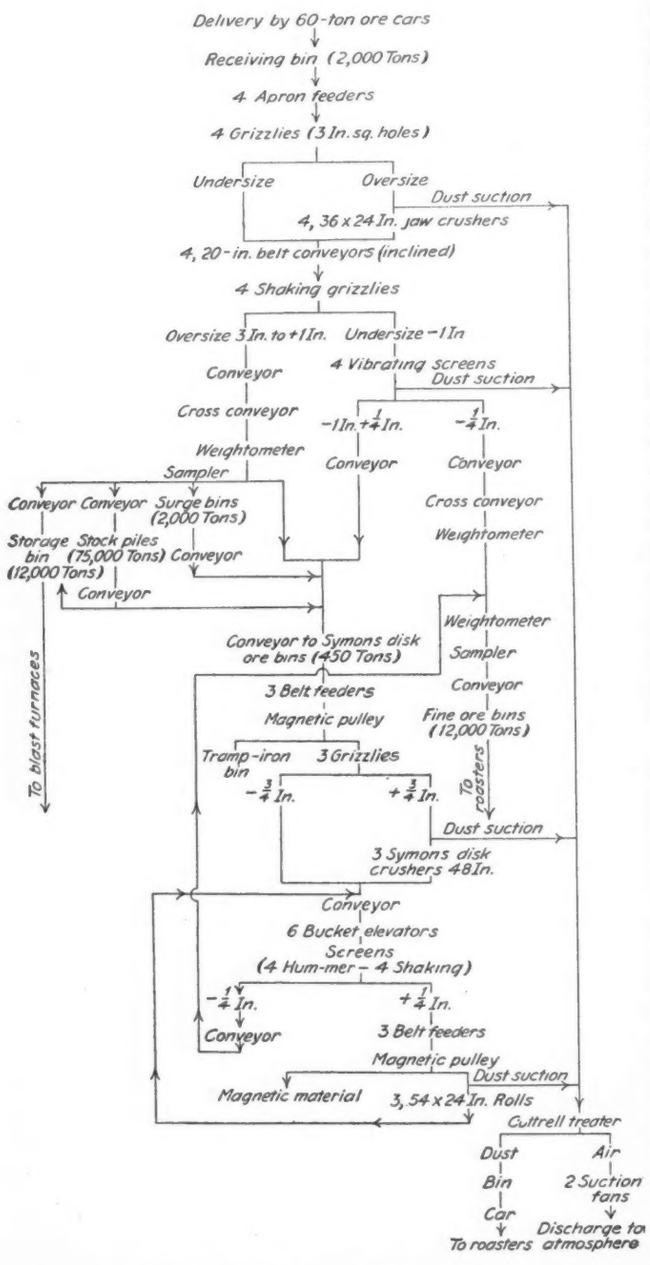
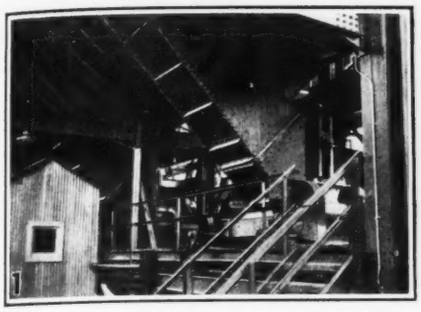


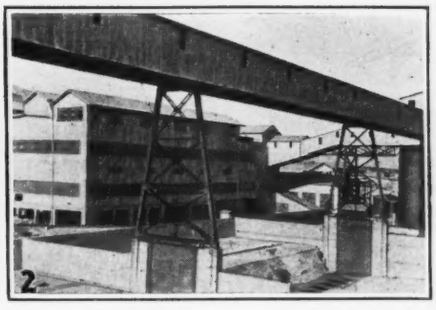
Fig. 1—Flow sheet of the United Verde crushing plant

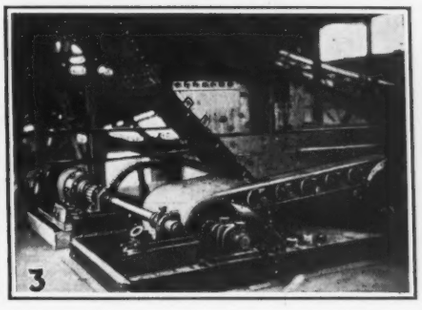
The reverberatory furnace requirement is ¼-in. material or smaller and the blast furnace is limited to 3½ in., maximum size. Mechanical handling and the position of the site at the smelter influenced the design of the crushing plant. The site is gently sloping and is contiguous to the fine- and coarse-ore bins. The principal parts are the rock-crusher house and receiving bins, the screening house, the fine-crushing house, the stockpiles and the dust plant. The capacity as designed is 4,000 tons per eight hours for the rock crushing and screening divisions and 4,000 tons per sixteen hours for the fine-crushing division. To provide for the increased coarse-crushing capacity, two circular steel bins are installed as surge bins, temporarily to hold the excess. This excess is returned to the fine-crushing plant by an inclined conveyor. The ore to be crushed ranges from the hard massive sulphide ore of the lower levels to several kinds of ore from the steam-shovel pits varying from hard siliceous ore to more or less clayey material. In general, there is a preponderance of hard ore and less of the clayey sticky varieties. The plant is arranged to route all of the material through the primary crushers and to the coarse-ore bins or stockpiles; or to route all of the material through the primary crushers and all, or part, through the fine-crushing plant to the fine-ore bins. The conveyor system is especially elaborate to provide for the largest possible flexibility in routing the material to one or all of three major points, the stockpile, the coarse-ore bin and the fine-ore bin.

The flow sheet of the plant is shown in Fig. 1; the general plan in Fig. 2. Storage is provided at three points, the receiving bins, the surge bins and the Symons crusher bins. The aggregate storage capacity is 4,950 tons. Additional storage is afforded by the three stockpiles, each of 25,000 tons' capacity.

Crushing is divided into three separate stages. The primary breakers are four 36x24-in. Allis-Chalmers jaw crushers. These are balanced and are provided with heavy flywheels belted by short-center belts, with tighteners, to 125-hp. motors. The 48-in. Symons disk crushers are of the vertical type. Three disk crushers have been installed and foundations for a fourth have been constructed. Three 56x24-in. Traylor rolls are provided and foundations for a fourth set have been constructed. The disk crushers are driven by 75-hp. motors and the rolls by 150-hp. motors. The installed motor capacity is 500 hp. for coarse crushing, 225 hp. for intermediate crushing and 450 hp. for fine crushing. The rolls are driven from a countershaft, the open belt being held taut by a belt tightener.







In No. 1 is shown the detail of the suspended bin, spout, and coarse-ore feeders. No. 2 shows the stockpiles and the conveyor system. In No. 3, the belt feeders to the Symons crushers are seen

Separate feeders are provided for each crushing unit. The coarse-crusher feeders are of the apron-plate type, driven by a variable speed motor, which is connected to a speed reducer, and this, in turn, to the driving pinion. The feeders for both the disk crushers and the rolls are of the belt type, each driven by a variable speed motor with a speed reducer interposed between the motor and driving pinion. Each head pulley is a magnetic pulley which removes small tramp iron and discharges into a small bin situated beneath the feeders. The use of the magnetic pulley is almost a necessity at this point owing to the damage that tramp iron can cause in a disk crusher.

The Symons disk feeders receive ore from a bin, the chutes of which are provided with a device for controlling the thickness of the ore stream. A similar device is used upon the chutes of the apron plate feeders serving the rock crushers. The roll feeders receive the oversize from the final screens directly.

Screening is accomplished by stationary grizzlies, shaking grizzlies, and shaking and vibrating screens. The feed of the rock crushers discharges upon inclined manganese steel grizzlies, 3-in. square holes, the undersize and crusher product being received upon inclined belt conveyors which discharge upon shaking grizzlies that separate the minus 1-in. material from the ore stream.

The feeders to the Symons disk crushers discharge upon inclined manganese-steel grizzlies that remove minus $\frac{3}{4}$-in. material and discharge upon an inclined belt conveyor which also receives the discharges of both the disk crushers and the rolls. The areas of the stationary

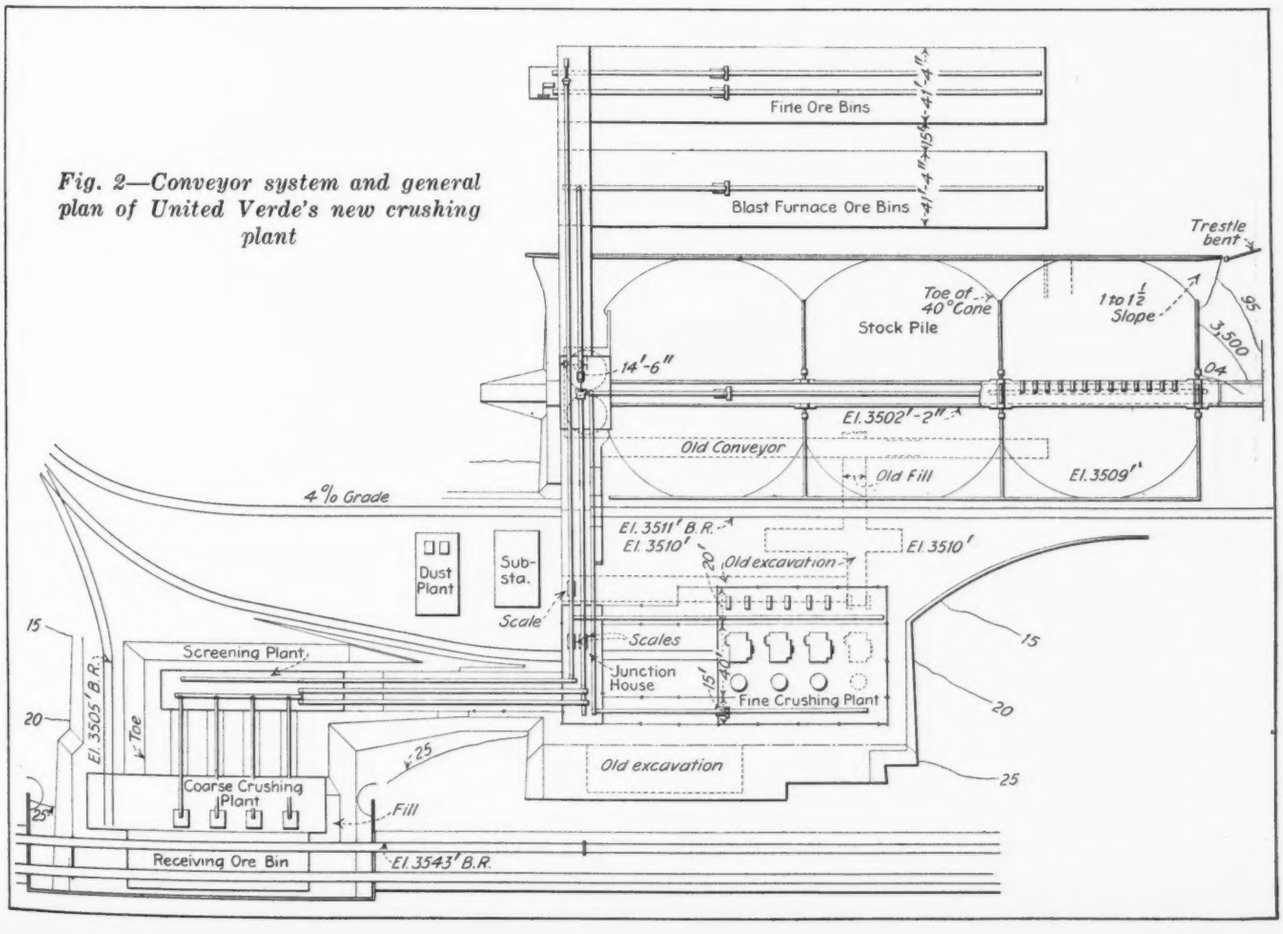


Fig. 2—Conveyor system and general plan of United Verde's new crushing plant

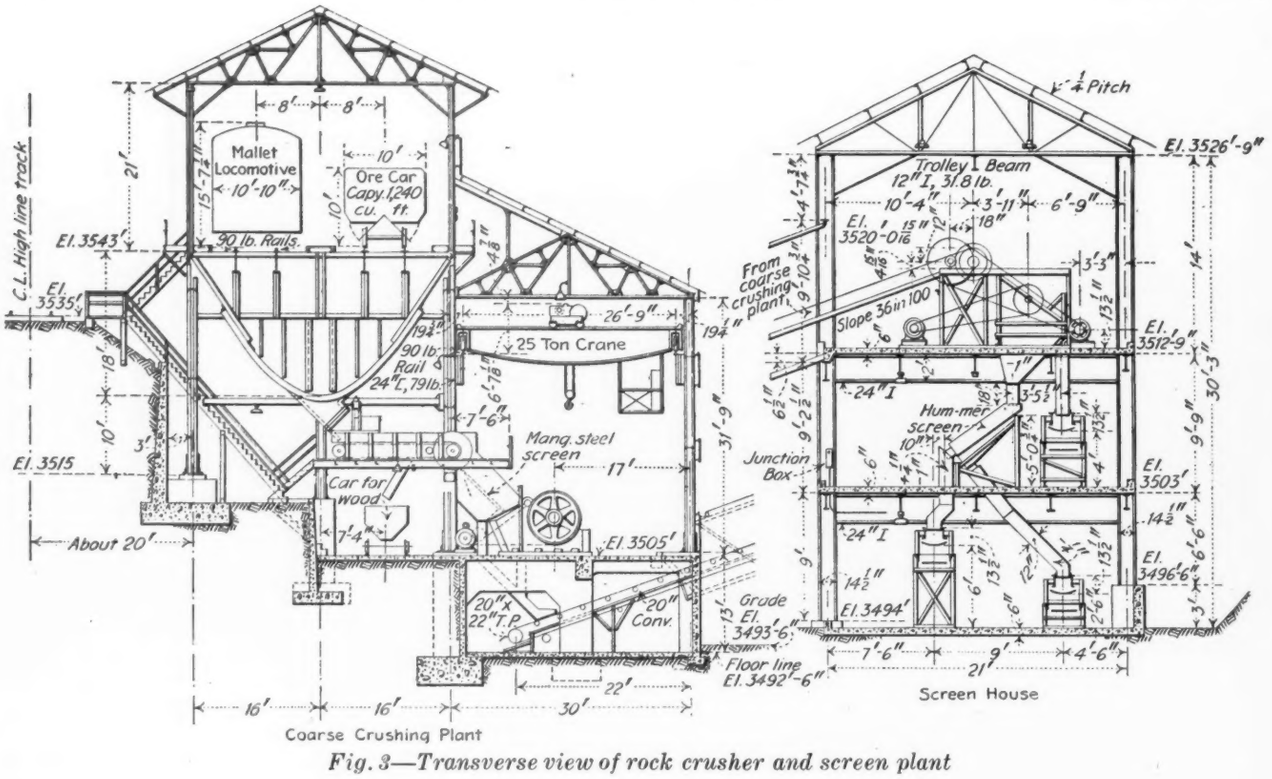


Fig. 3—Transverse view of rock crusher and screen plant

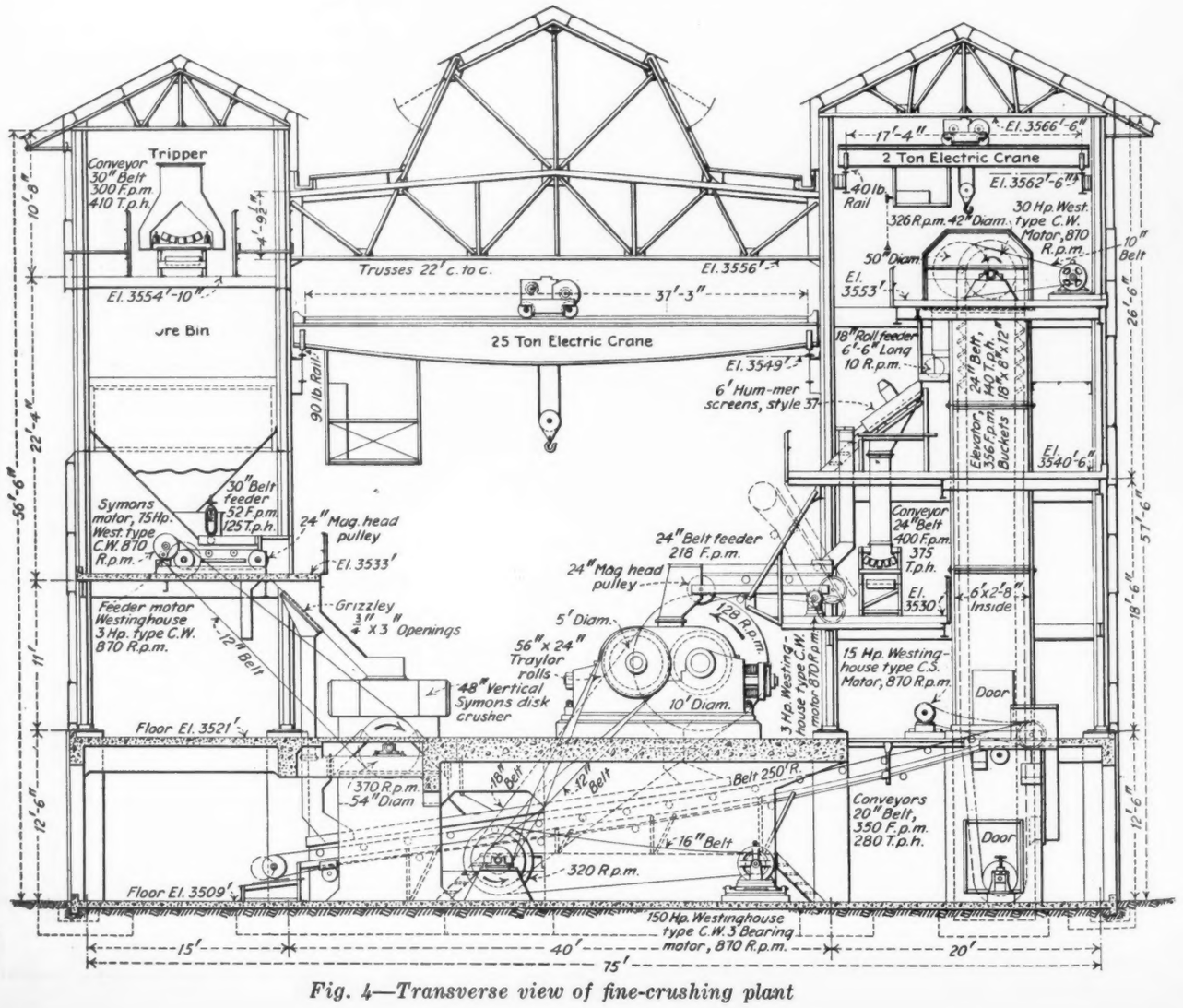
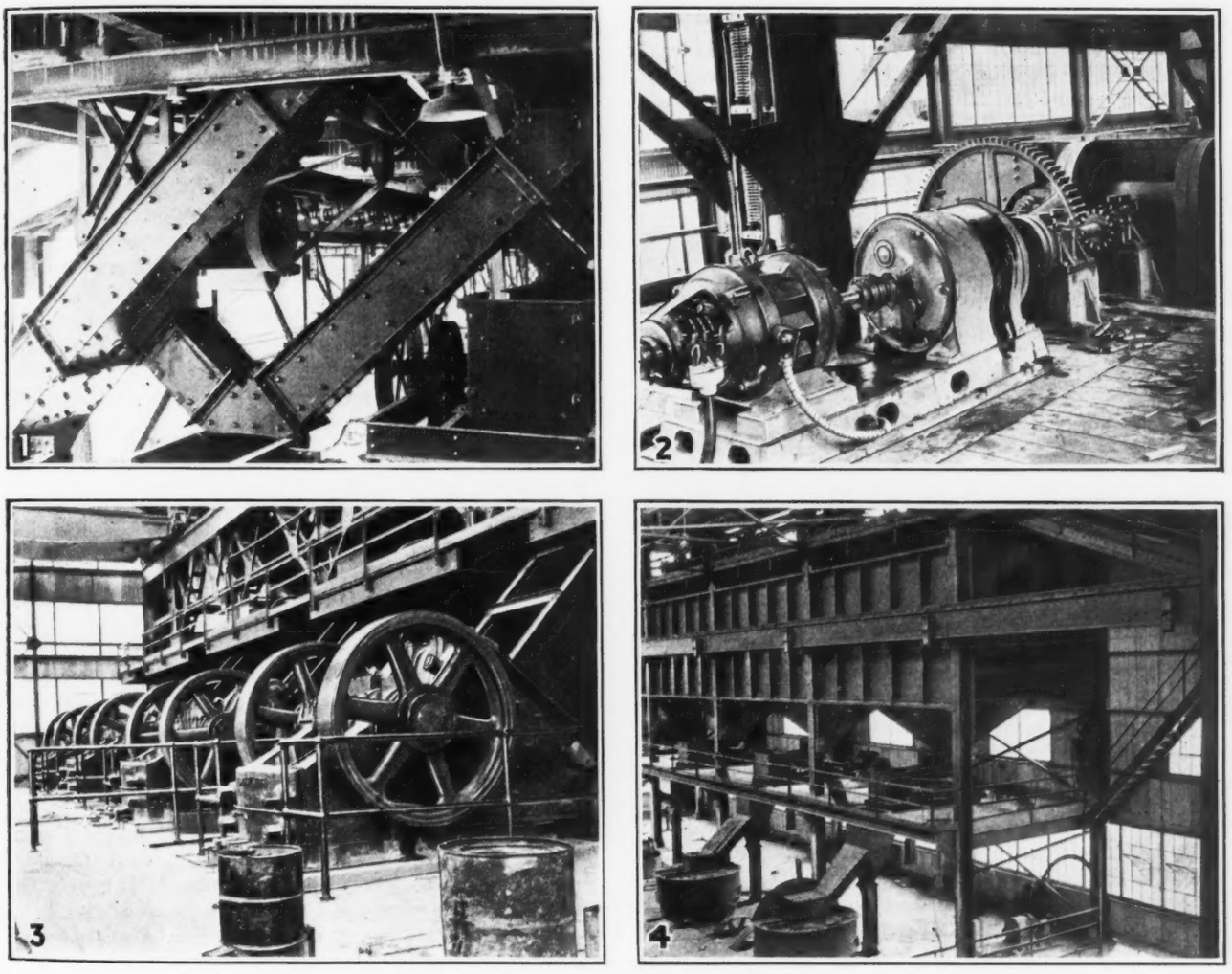


Fig. 4—Transverse view of fine-crushing plant

grizzlies are comparatively restricted and it will be of interest to note how well they perform their function. The shaking grizzlies and primary vibrating screens are grouped in a separate building. The coarse crusher product is delivered by the inclined belt conveyor to the shaking grizzlies which separate minus 1-in., delivering this size to the vibrating screens on the floor below and the oversize upon a conveyor belt. The vibrating screens separate minus ½-in. and minus ¾-in. plus ½-in. material, delivering each product to separate belt conveyors. There are thus three lines of belt conveyors charges upon an inclined conveyor (this also receives the discharge from the inclined conveyor serving the surge bins), which delivers to the Symons-disk bins. The discharge of the third conveyor can also be routed to the surge bins or stockpile. Trippers distribute the ore in the Symons bins and on the stockpiles. Two lines of conveyors equipped with trippers deliver to the fine-ore bins and a single belt conveyor to the coarse-ore bins.

The belt conveyor sizes are 20, 24 and 30 in. in width. There are twenty-five conveyors in the plant. Belt speeds range from 250 to 380 ft. per minute, the width



1. Conveyor spouts and transfers. 2. Coarse-ore-feeder drive. 3. Jaw crushers. 4. Symons disk crushers and bins.

receiving the product of the shaking grizzlies and screens. Two types of vibrating screens, the Mitchell and Hum-mer, have been installed. In addition a Cole vibrating grizzly has been installed upon the grizzly floor of the screen house.

Three inclined belt conveyors receive the product from the three horizontal conveyors in the screen house; and by a system of gates and chutes the various products can be diverted to these conveyors, one of which receives minus ½-in., or finished size, and discharges upon a cross conveyor leading to the fine-ore bins (this stream passes over a weightometer); the second receives the coarse ore or intermediate size, and discharges upon a second cross conveyor which delivers over a weightometer to the surge bins or to the stockpile conveyor; the third receives the coarse or intermediate size and discharges upon an inclined conveyor (this also receives the discharge from the inclined conveyor serving the surge bins), which delivers to the Symons-disk bins. The discharge of the third conveyor can also be routed to the surge bins or stockpile. Trippers distribute the ore in the Symons bins and on the stockpiles. Two lines of conveyors equipped with trippers deliver to the fine-ore bins and a single belt conveyor to the coarse-ore bins.

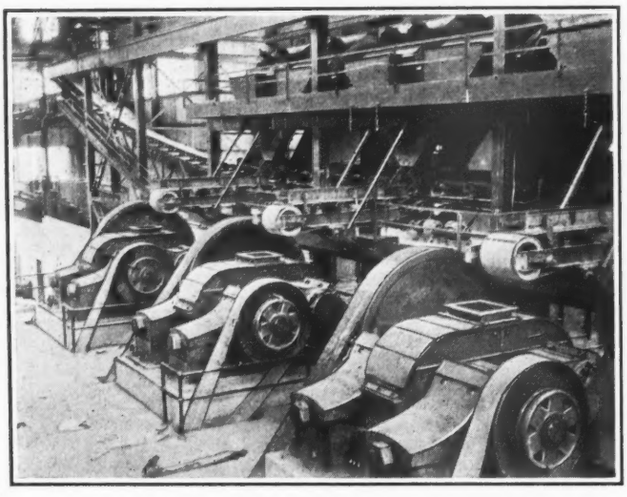
The belt conveyor sizes are 20, 24 and 30 in. in width. There are twenty-five conveyors in the plant. Belt speeds range from 250 to 380 ft. per minute, the width of the belt and the capacity determining the speed of a given conveyor. The wide belts are used on coarse and the narrow on fine ore. Short conveyor belt runs are driven by a motor, speed reducer and sprocket chain to a sprocket on the head-pulley shaft; intermediate lengths are geared and long inclined conveyors are equipped with tandem drives. Inclined conveyors are limited to an angle of 19 degrees.

The product from the Symons disk crushers and the rolls is received upon inclined belt conveyors placed beneath and centered on each set of rolls and crushers. Each conveyor discharges into a pair of bucket elevators and these in turn discharge onto a pair of Hum-mer screens, (one set of rolls is provided with four shaking screens), the undersize product being spouted to a belt conveyor and the oversize to the belt feeder of the

rolls. The oversize, after passing the rolls, is returned to the bucket elevators. The undersize from the grizzlies above the disk crushers forms a bed upon the belt conveyor which receives the ore streams from both the disk crushers and the rolls. A similar arrangement provides for the protection of the belt conveyor receiving the ore stream from the rock crushers. Each bucket elevator is driven by a 30-hp. motor which is belted to a countershaft driving the head pulley through gears.

The sampling plant is yet to be built. It is planned to make one sample cut (5 per cent) at the discharge into the surge bins, reducing this cut by gyratory, rolls, and riffle samplers. The fine-ore stream will be cut by continuous riffle samplers, after an initial cut by a Schneider sampler. The final cut will be less than 0.5 per cent.

Alternating current motors are used throughout, all motors over 50 hp. being on a 2,200-volt circuit and



Crushing rolls. Belt feeders and final screens. Finished-size conveyor in left background

motors 50 hp. and less being on a 440-volt circuit. A separate substation serves the plant as a whole. Outside wiring is underground and inside wiring is in conduits. The aggregate horsepower is 1,425 hp. (2,200-volt circuit), 1,100 hp. (440-volt circuit) and 100 hp. on direct-current circuits, a total of 2,625 hp. connected load. It is estimated that the 2,200-volt load will approximate 1,000 hp., and the 440-volt load 880 hp. Push-button control is installed on the motor equipment generally. Motors are equipped with low voltage and overload release. Remote controls are installed on conveyor drives and principal crusher drives. On long incline conveyors as many as five push-button stations have been placed at convenient points. The control system is interlocked and automatically operates upon conveyors in series. Thus, if anything goes wrong, all conveyors and feeders in a given "chain" are simultaneously stopped by a single stop button. This prevents piling up. A system of electric horn signals operable from various points is a valuable accessory of the electrical installation.

Dust collection is provided for by four separate air mains that serve the crushers, screens, Symons crushers and rolls respectively. These mains are provided with cleaning pockets and gates at intervals of 15 ft. The exhaust mains connect with a Cottrell treater for precipitation of the dust. Two 45,000-cu.ft. fans, direct-driven by 125-hp. motors, exhaust the air from the system. It is expected to maintain a 6-in. vacuum at the fans. The Cottrell treaters are equipped with plates and vertical wires. The dust is received in hoppers and drawn off into cars and sprayed before it goes to the roasters.

Three types of bin construction are used: the suspension or curve-bottom type, a combination of vertical steel walls and pyramidal bottom hoppers, and the steel circular type.

It is estimated that thirty-five to forty men will be required per day to operate the plant on the basis of eight hours for the coarse-crushing and screening, and sixteen hours for the fine-crushing division. The power requirement is about 3 kw.-hr. per ton, which, at 1.75c. per kw.-hr., brings the power cost to approximately 5c. per ton. The labor cost will be approximately 5c. per ton, bringing the total direct cost to about 10c. per ton.

The buildings are steel frame with concrete floors. The walls are of galvanized corrugated steel. The window sash is steel. The design is clean cut and special attention has been paid to belt power drives to make them as safe as possible. The lighting system is excellent both for night and day operation. Traveling crane equipment is provided in the coarse- and fine-crushing divisions. The cranes are of 25 tons' capacity. A 4-ton P. & H. traveling crane is provided on a runway above the bucket elevators.

The grouping of the machines is such as to admit of unit operation. The four coarse-crushing units have each separate screening units in the screen house. In the fine-crushing division, a Symons crusher and a pair of rolls, together with conveyors, elevators and screens, are operated as a single unit. As each coarse-crushing unit is approximately of 1,000 tons' capacity per eight hours and the three fine-crushing units are equivalent to the capacity of two coarse-crushing units, the capacity of the plant with two coarse-crushing units in reserve is 2,000 tons to ¼-in. size in one 8-hour shift. Two shifts' operation would thus provide for the daily mine output. Bypassing the fine-crushing plant, the coarse-crushing plant could handle the mine output to blast furnace size in one 8-hour shift.

The plant was designed by J. B. Johnson, chief engineer of the United Verde Copper Co., and his staff. David Cole was consulting engineer. Through the courtesy of the company I was given the opportunity of visiting the new plant and gathering the foregoing notes.

Queensland's Gold Yield Increased in 1923

Queensland's gold yield for 1923 showed an increase of 5,482 oz. and £23,284 in value, compared with the yield of the previous year, according to the *Queensland Government Mining Journal*. The yield for December was 8,440 oz., valued at £35,851, compared with 10,443 oz., valued at £44,360, for December of 1922. The yield for the twelve months of 1923 was 84,814 oz., valued at £360,265, compared with 79,332 oz., valued at $336,981 for 1922, or an increase for 1923 of 5,482 oz., and £23,284 in value. The yields for December, 1923, were as follows, those for December, 1922, being in parenthesis: Mount Morgan, 5,858 oz. (7,906); Mount Coolon, 1,269 (nil); Gympie, 980 (1,191); Chillagoe, 155 (nil); Charters Towers, 94 (480) oz. There were no dividends reported as declared in 1923, but in the previous twelve months the amount was stated to be £19,047.

Cost Sheet for the Mine Foreman

Data Supplied Should Be Easily Interpreted

By William F. Boericke
Mining Engineer, Philadelphia

THE AVERAGE MINE FOREMAN or shift boss does not possess a technical education, but with a moderate amount of explanation he will readily grasp the significance of cost figures, and derive an immense amount of benefit from them as well. The cost sheet may easily be so contrived that it will provide an invaluable point of contact between the management and the foremen. But to be of the most benefit, the figures must be arranged in such a form as to be readily comprehended, and the method of deriving them must be clearly understood by the men. In short, they must have confidence in the accounting department. Too often the figures are burdened with extra embellishments of overhead, depreciation, and other factors all perfectly clear to the trained accountant but almost meaningless to the man in the ranks. Consequently, he often feels that the figures do not give him a square deal, and do not truly reflect an index of his work and the efficiency of the labor under his direction. "Figures don't lie, but liars can figure," he quotes cynically, and a criticism based on such reported costs is felt to be unjust.

Special Forms for the Foreman

The foreman is not an engineer, or at least is not holding an engineer's job and responsibilities, and presumably lacks the engineer's ability to analyze figures and give them their proper weight and significance. Hence a special form of cost sheet for him is generally desirable, in which only the essentials are given, with the arrangement from a mechanical standpoint simple and plain, adapted to a man whose place is not in the mine office but underground with his men. All the figures required can be compressed on a single sheet of paper, ready to insert in a small loose-leaf notebook of the right size to carry in the pocket. It is unnecessary to carry out cost figures beyond the first place of decimals.

These figures should emphasize the cost of operations and material for which he is resposible, and should stop there. As the foreman has been chosen not for his diploma but because of his ability to handle men, the most valuable figures on the cost sheet for himself and the company in furnishing an index of his efficiency are the various subdivisions of the labor cost, and, wherever possible, these should be gone into in great detail. It is poor business to stress the subdivisions of the costs of materials and supplies. These comprise but 15 per cent or 20 per cent of the total when labor costs amount to over 60 per cent. However tempting may be the opportunity to work on the cost of some supply item, it is generally true that the same supervision and thought, applied to any subdivision of the labor, will show a much larger proportionate gain for the company.

For instance, the cost of rail and track supplies may look too high. But if the entire item is only 1 per cent of the cost sheet, while the labor cost of track men is 5 per cent there is evidently a larger chance for improvement in cutting down the labor cost, and not until that has been thoroughly examined is it worth while to lay emphasis on the minor cost.

The Difference Between Office and Mine

Unless the foreman has remarkable analytical ability (and in that event it is unlikely he would be a foreman) he is going to have only so much time for cost-sheet analysis, and it is essential that this be spent on what will accomplish the most good from the company standpoint. It is the biggest sort of an error to expect too much. We can all sit back in the office and declare that this, that and the other item is too high, and prove it—on paper. It is quite another thing to tackle actual underground conditions, maybe disrupt an organization, which, faulty no doubt, is at least getting the work done, and attempt to make a clean-up overnight. Make haste slowly, and concentrate on the items that will show the largest return. The minor matters can be corrected later on.

The superficial wastes of a mine can be seen by anyone with a good pair of eyes, and are frequently given altogether too much weight in condemning a foreman for inefficiency and poor work. A yard of fuse thrown away on the muck pile looms up like a red light on a freight car, but it would take many wasted yards to pay for the idleness of the shift in case the shots had been delayed by lack of fuse. Anyone can spot a wasted stick of powder lying in the drain ditch (and it should be picked up and destroyed), but the change in the chute arrangements by which one man is accomplishing what it formerly took two men to do is generally not appreciated until explained and shown up on the cost sheet. Consequently, the cost sheet for the foreman should emphasize, and give detail to, those items which come directly under his eye, and which by his efforts to improve will bring the greatest saving to the company. Everything else should be subordinated.

A practical form for his use is suggested on page 402. This form of cost sheet gives everything essential for the foreman, without distracting his attention to operations over which he has no control. Emphasis is placed on subdivision of labor, and this may be gone into in greater detail if desired. The "B" division of material and supplies may be still further compressed if some of the items amount to little. Under this head comes the question of including the cost of new equipment, such as a new pump or a new drill. Common sense indicates that the cost of such items, if they are to be included in the cost sheet and not charged directly to capital account, and subsequently amortized, should be distributed over several months' time, so that the cost in any one month should not appear disproportionately large.

Mining Cost Sheet for——Mine	Month of—— 192—		
A. Labor Cost	Total Cost	Cost Per Ton	Year's Average
Shovelers	.....	.....	.....
Drillers	.....	.....	.....
Trammers	.....	.....	.....
Timbermen	.....	.....	.....
Powdermen	.....	.....	.....
Trackmen	.....	.....	.....
Pumpmen	.....	.....	.....
Shaftmen (landers, cagers, skip-men—not men in shaftwork, who should be charged to development)	.....	.....	.....
Other miners	.....	.....	.....
Total labor cost	.....	.....	.....
B. Material and Supplies			
Powder, including caps and fuse	.....	.....	.....
Timber	.....	.....	.....
Drill repairs and supplies	.....	.....	.....
Track supplies	.....	.....	.....
Other mine supplies	.....	.....	.....
Total material and supply cost.	.....	.....	.....
C. Power			
Kw.-hr., compressor, at .. cents per kw.-hr.	.....	.....	.....
Kw.-hr., pump, at .. cents per kw.-hr.	.....	.....	.....
Kw.-hr., miscellaneous underground use, not including hoist.	.....	.....	.....
Total power cost	.....	.....	.....
Total mining cost			
Tons hoisted			
Concentrates produced			
Per cent recovery			

Power Data Serves as a Check

The "C" item of Power is sometimes omitted, but provides a valuable check on the efficiency of drills and pumps, as well as suggesting where to look for power losses in air lines and wiring, if serious variation from month to month appear. It assumes that electric power is used on the compressor and pumps, with individual meters. The additional cost of these instruments is always justified. Where it is not possible to figure individual consumption of power direct, an approximation of horsepower-hours is sometimes feasible.

Next to accuracy, the most essential element for the cost sheet is timeliness. The cost sheet is not a historical document. Interesting as it may be as a faithful record of work that has been done in the past, its main value to the foreman is for the *present*, in providing a tool to correct present inefficiency and waste. For this purpose, the sooner it is in his hands where he can use it, the better. It is far better to have a crude but accurate cost sheet handed to him soon after the first of the month than a much more elaborate and detailed one that follows a week later. Here is where the accounting department and the operating frequently go to the mat. The men in the office naturally like to turn out a good job, complete in every detail, and from a Machiavellian standpoint are inclined to stress the importance of including every refinement. The management demands the figures the instant they are accurately determined, and expects that extra midnight oil be burned to accomplish this. The management usually wins.

In times of rapidly changing wage scales and contract rates, or when material costs vary widely in a short space of time, the cost per ton is likely to be decidedly misleading in judging the efficiency of the work, especially if comparison be made with past records. For instance, a horizontal increase of 25 per cent in labor rates, where labor comprises 60 per cent of the cost, would increase the cost per ton 15 per cent if tonnage remained stationary. Such an increase in wage scales might be entirely beyond the power of the management to prevent; a labor scarcity, a strike, a sliding scale increase due to an increase in the price of the metal, might cause it. In such an event, a corresponding increase in tonnage to take care of the additional cost will certainly not be attained overnight. Similarly, a large increase in the cost of powder or timber might cause a sudden rise in the unit costs of these items, and apparently reflect unfavorably on the management. This was the case in nearly every mine during the war, and afterward, and made the comparison of cost figures with pre-war standards practically impossible to anyone not acquainted with the changes that had taken place.

Performance vs. Cost Figures

To obviate the difficulty of making such comparisons, performance figures were introduced as an accompaniment of the cost sheet, and serve the useful purpose of making comparisons of work always possible without bringing in the cost element. In many cases they are more valuable than cost figures, because no additional explanations or alibis are needed. In fact, during the war, many managers cut out cost figures entirely and substituted the former, believing that the cost figures simply tended to confuse the men.

The most useful performance figures are: Tons mined per man underground, tons shoveled per mucker, tons broken per machine shift, tons trammed per man, tons broken per pound powder, or pounds powder per ton broken, and feet drilled per machine shift.

The duty of the foreman is to get the work under his direction done as efficiently as possible, and at the lowest cost. It is not his concern, except indirectly, of course, whether the operation is profitable. Every man worth his salt wants his work to be worth while and wants to be engaged in a profitable operation, but it is a mistake to permit the cost sheet for the foreman to have any resemblance to a profit-and-loss statement. The two must be kept sharply distinct. Good work can be done, so far as operating goes, though the balance sheet for the month shows in the red. Though a satisfactory margin of profit covers a multitude of sins, it is in itself no indication of a good cost sheet. Rising ore markets have kept many a poorly managed mine on its feet, though under normal conditions it would have been shut down.

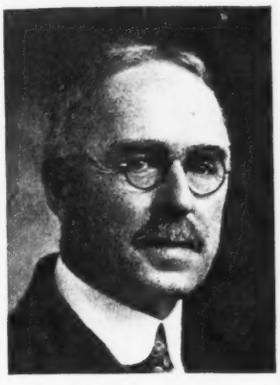
The instant the management lays more emphasis *to the foreman* on profit figures, than on reducing costs, the foreman naturally turns to the easiest way to accomplish it—to mine a higher-grade ore, take the cream of the pay-streak, and run up the mill recovery of concentrates. This, of course, in time leads to bad mining. In an attempt to get richer ore, he lets his costs run up and his tonnage run down. Hence, so far as the foreman is concerned, profit-and-loss operations should be left severely alone. Efficient operation is his incentive, and the figures furnished him should bear on that alone.

It is a mistake to furnish cost figures on concentrates or final product. As the Cousin Jack says, "I didn't put the bloody ore in the ground; I can just take it out." A knowledge of a satisfactory profit will too often provide the excuse to neglect to make changes in a situation that might be improved. Conversely, a lack of comment on a good cost sheet, even though the financial results are disappointing due to outside conditions, will engender the feeling that good work is not appreciated.

Marketing of Gypsum

Trade Practices in Handling This Important Non-Metallic Mineral Product

By Frank A. Wilder
President, Southern Gypsum Co., North Holston, Va.



Frank A. Wilder

CRUDE GYPSUM is used as retarder in portland cement and as a fertilizer. Relatively small quantities are sold for filler in paint and paper, for flux with galena concentrate and with certain nickel ores; for crayon, phonograph records and buttons; and for filtering certain kinds of oils. For these purposes, with the possible exception noted below, anhydrite, which is often associated with gypsum, may be used as well as gypsum. Because anhydrite lacks the water of crystallization that characterizes gypsum, it cannot be transformed into plaster of paris by heat. It has a higher SO_3 content, which is in its favor as cement retarder and as fertilizer, and its lower solubility can be overcome by finer grinding.

Anhydrite vs. Gypsum

For high alumina cements there seems to be some question as to whether anhydrite is as effective as gypsum. Its solubility is less than that of gypsum, and it does not seem to go into solution fast enough to prevent flash sets due to the high alumina content of the cement. Mixtures of gypsum and anhydrite in which the anhydrite runs up to 25 per cent of the mixture seem to retard any type of clinker satisfactorily and to be more effective than gypsum alone for the average clinker.

Gypsum, after calcining, is used in the manufacture of interior plasters, plaster blocks, plaster boards, and for the numerous lesser purposes that are usually associated with it under the trade name "Plaster of Paris."

The principal producing points in the United States are Oakfield, Akron, Wheatville and Garbutt, in New York; Plasterco and North Holston, in Virginia; Port Clinton and Gypsum, in Ohio; Alabaster and Grand Rapids, in Michigan; Fort Dodge and Centerville, in Iowa; Blue Rapids and Medicine Lodge, in Kansas; Black Hawk and Piedmont, in South Dakota; Ada, Homestead Manlow, Acme, Eldorado, and Southard, in Oklahoma; Agatite, Acme and Plasterco, in Texas; Sigurd and Gypsum, in Utah; Gypsum, in Oregon; Douglas, in Arizona; Mound House, in Nevada; Laramie, Red Buttes, and Greybull, in Wyoming; Hanover and Trident, in Montana; Stone City and Waldale, in Colorado; Acme, in New Mexico; Amboy, in California, and Gypsum, in Alaska.

Gypsum imported from Nova Scotia reaches the Atlantic seacoast in considerable quantities. The gypsum industry in New York City and on Staten Island is extensively developed, the raw material being brought in barges from Windsor and near-by points. A calcining plant using Nova Scotia rock is situated at New Haven, Conn. Considerable quantities of anhydrite are shipped from Nova Scotia to Norfolk, Va., where it is ground for fertilizer.

The localities where most of the crude gypsum is used are determined by the location of portland cement mills. Although Pennsylvania still leads in the production of cement, each year new mills are being built nearer to consuming points. In the South the Birmingham district is rapidly coming to the front, and in the Middle West, Illinois, Missouri, and Iowa produce all the cement used within their borders.

Mineral Used for Fertilizing Peanut Land

About one-third of the crude gypsum used as fertilizer is sold in ten or twelve counties in eastern Virginia and North Carolina. This peculiar situation grows out of the fact that gypsum is an essential fertilizer in connection with the growing of the large Virginia, or Jumbo, peanut. This is the nut that is commonly sold in the shell, from the peanut roaster. Though a good fertilizer for the smaller Spanish nut, which is used in the vending machine and by candy makers, gypsum is not as essential for this type, and consequently relatively small amounts of gypsum fertilizer are used in Georgia, Alabama, and Texas, where the Spanish variety is largely grown. For most crops, but particularly for alfalfa, considerable quantities of agricultural gypsum are used in Washington and Oregon. The soil in many localities in these states is strikingly deficient in sulphate sulphur, and this deficiency is supplied most cheaply and effectively by the use of finely ground gypsum.

Much more gypsum would be used as fertilizer were it not for the fact that acid phosphate as ordinarily manufactured, by the reaction of sulphuric acid on raw phosphate, contains a large amount of gypsum. This amount is sufficient for some soils and some crops. New processes by which phosphate is made soluble without the use of sulphuric acid are being introduced, and if they should ultimately displace acid phosphate the use of gypsum in agriculture would quickly increase from the present figure of 100,000 tons to many times that amount.

In California and some other Western states considerable quantities of gypsum are used to neutralize black alkali.

Except for gypsum brought by boat from Nova Scotia or Alaska, only a small quantity of gypsum is shipped away from the mine or quarry for further treatment. In almost every instance calcining plants are situated at the point where the mineral is produced and are controlled by the same management. Moreover, in connection with the same plants, most of the calcined gypsum is further manipulated for the production of wall plaster, gypsum blocks, and wall board. Calcined

gypsum is shipped to mixing plants in the large cities, where other ingredients, including sand, are added, the product being a complete wall plaster. Scattered about the country, also, are some small plants that buy calcined gypsum and manufacture blocks and boards. Nine-tenths of all products made from gypsum, however, are fabricated at mills situated at the point where the mineral is produced.

Chemically, gypsum is calcium sulphate, with two molecules of water of crystallization, $CaSO_4 2H_2O$. The pure mineral contains

Lime sulphate, $CaSO_4$:	
Lime, CaO	32.6
Sulphur trioxide, SO_3	46.5
Water, H_2O	20.9
	100.0

Anhydrite is simply $CaSO_4$, and since it lacks water its SO_3 content may reach 58.8 per cent.

Where anhydrite occurs abundantly, as in Nova Scotia, it is seldom found pure, but occurs commonly with more or less gypsum scattered through it, and at times grading into gypsum by almost imperceptible degrees.

For portland cement, except for high alumina and low lime clinkers, under which conditions, as has been stated, the lower solubility of anhydrite seems to make it somewhat less effective than gypsum, the SO_3 content of the mineral is the only chemical characteristic that is closely scanned by cement mill buyers. Impurities should not be present carrying much magnesia, but as such impurities do not occur ordinarily with gypsum, the point is theoretical rather than a matter of practical importance. Gypsum for cement mill use is generally bought on the basis of its SO_3 content, 42 per cent SO_3 being a common specification.

Impurities Sometimes May Be Desirable

For calcining it is essential that the mineral used have the full water of crystallization. For the manufacture of wall plasters, certain amounts and kinds of clay are not objectionable, and may be desirable. Some sorts of clay add to the plasticity of the plaster, and plasticity in gypsum plasters is a property just as important as tensile strength. Gypsum for use in making wall plasters may carry clay up to 30 per cent and still have ample strength and hardness, provided the plaster made therefrom is not oversanded. Gypsite is extensively used for the manufacture of wall plaster, and on account of the plasticity and easy working qualities of the plaster made from it the so-called "mud plasters" are very popular in some sections of the country. Gypsite is a secondary deposit of recent origin, and consists of minute crystals of gypsum with which is mixed from 15 to 30 per cent of colloidal clay. These deposits are on or near the surface and are delivered to the calcining kettle at a very low cost.

The color of crude gypsum is a relatively unimportant matter. The trade calls for a few hundred thousand tons of white plaster of paris, or finishing plaster, each year, and for this purpose a white gypsum is desirable. It may be well to state at this point that standard plastering consists of three-coat work. The first, or scratch coat, is applied directly to the plastering background, and a brown coat follows, which is applied to the scratch coat, and brings the wall out to standard grounds. Lastly, where a white wall is desired, a very thin skim coat made of lime putty and plaster of paris is applied. The demand for a white plaster of paris for this skim coat rests largely on trade traditions. Since the plaster of paris used in white finish is mixed with four parts of lime putty, the color of the wall is wholly controlled by the lime. However, the demand for a white finish, though very limited in volume, is a persistent one, and only certain Nova Scotia, Kansas, and Oklahoma mills are in position to cater to this demand.

The texture and grain of the gypsum rock has a good deal to do with the types of machinery that may be used to the best advantage in crushing and calcining, but if the right kind of machinery is used, the texture of the rock has little to do with the quality of the finished product. By way of illustration, it may be said that rotary calciners of the cement-mill type are being used successfully in the various gypsum mills of New York State, but that in Iowa and elsewhere attempts to use them instead of the so-called "Kettle" have been expensive failures. Success with the rotary calciner to date seems to be limited to those gypsums that crush with a minimum of fines. In the rotary the fines tend to over-calcine or dead-burn, whereas in the kettle, since fine grinding takes place before calcining, there is no such danger. The New York gypsum is dense and close grained; the Iowa mineral is more friable.

The proper sizing of gypsum at the shipping point, for portland cement mill use, is of considerable importance. Many cement mills accept readily everything that passes a 3-in. ring. Other mills, on account of the nature of the feeding devices used, require smaller sizes, and a few mills insist that the fines be taken out.

Committee C-11 of the American Society for Testing Materials, which has been at work for some years on the problem of standardizing gypsum and gypsum products, has proposed the following as tentative specifications for crude gypsum, and these have been accepted as tentative by the society and so published:

Gypsum may be marketed in any of the following forms and sizes:

(a) Run-of-mine.—The form in which it comes from the mines or quarry.

(b) Crushed.—Run-of-mine gypsum further reduced so that all of it will pass through a 2-in. (50.8 mm.) ring, and not less than 10 per cent shall be retained on a No. 2 sieve.

(c) Crushed Gypsum, Sized.—Shall all pass a No. 3 sieve, and not less than 10 per cent shall be retained on a No. 3 sieve.

(d) Ground.—Crushed gypsum further reduced to sizes suitable for specific uses. Ground gypsum may be marketed in any of the following sizes:

No. 1—Material of this size shall all pass a 14-mesh sieve, and not less than 85 per cent of it shall pass a 100-mesh sieve.

No. 2—Material of this size shall all pass a 14-mesh sieve, and not less than 60 nor more than 85 per cent of it shall pass a 100-mesh sieve.

No. 3—Material of this size shall all pass an 8-mesh sieve, and not less than 40 nor more than 60 per cent of it shall pass a 100-mesh sieve.

No. 4—Material of this size shall all pass a 100-mesh sieve.

The chemical composition, within the limits prescribed by Section 2, shall be a matter of contract.

Chemical Properties

Sampling

When gypsum is shipped in bulk, samples of about 5-lb. (2.25-kg.) each shall be taken at regular intervals during the complete loading or unloading of the carrier, in such a way as to accumulate at least 200 lb. (90-kg.) of material, and to represent correctly the percentages of both the coarse particles and the fines in the shipment. This shall be broken so that it will all pass a 1-in. (25-mm.) ring, thor-

oughly mixed, and reduced by quartering to provide not less than a 1-lb. (0.5-kg.) sample for the laboratory.

When gypsum is shipped in packages, at least 3 per cent of the packages shall be sampled. Samples shall be taken from both the surface and the center of the packages. These samples shall then be broken, mixed, and quartered as directed above.

All laboratory samples shall be placed immediately in an air-tight container and shipped to the laboratory for test.

Packing and Marking

(a) Gypsum may be shipped either in packages or in bulk.

(b) When shipped in packages for resale, the following information shall be legibly marked on each package or on a tag of suitable size attached thereto:

Name of manufacturer;

Form and size of material;

Chemical analysis of the material, giving the minimum percentages of CaO and SO_3;

Net weight of package.

(c) When shipped in bulk, a card containing the required information shall be conspicuously placed in the carrier.

Inspection and Rejection

Inspection may be made either at the point of shipment or at the point of delivery. The inspector representing the purchaser shall have free access to the carriers being loaded for shipment to the purchaser. He shall be afforded all reasonable facilities for inspection and sampling, which shall be so conducted as not to interfere unnecessarily with the loading of the carriers.

Any rejection shall be based on the specific cause of failure to conform to the requirements of these specifications, and shall be reported within ten working days from the receipt of the shipment by the consignee.

Claims for rehearing shall be valid only if made within twenty working days from receipt of notice of specific cause for rejection.

Crude gypsum is usually shipped to cement mills in bulk, loading being to the marked capacity of the car. Some mills request box-car shipment, but others prefer drop-bottom hoppers. Where box cars are called for by cement mills, no objection is offered to leaky roof equipment, and this helps the shipper, who can reserve his sound cars for wall-plaster shipments. Wall plaster is always shipped in sound box cars when they can be had, though in emergencies shipments have been made on tarpaulin-covered flat cars. For wall plaster the carload minimum varies from fifteen to thirty tons. The smaller minimum usually carries a somewhat higher rate, and is used in shipping to small towns where there might be some deterioration of the plaster in the warehouse before a large carload would be disposed of.

Wall plaster is always sold in bags, either of jute or paper. The jute bag carries 100 lb. of plaster, and the bag is sold and invoiced with the plaster. The price charged for these bags varies from time to time with the price of jute, though it is not practicable to change the bag price often. The present charge is 15c. per bag, or $3 for the bags used with each ton of plaster. These bags are redeemed by the shipper at the same price that was charged for them if they are shipped back in good condition, freight prepaid, within six months after the plaster is shipped. The provision for the return of the bags within six months is merely a nominal one, as it is customary for the plaster manufacturer to redeem bags even though they may not be returned for two or three years. The jute bag department of a large gypsum plaster mill is an important feature of the business. It adds greatly to the warehouse space required and to the work of the accounting department.

On account of the trouble and expense growing out of the use of jute bags the gypsum plaster industry has made a determined effort to encourage shipments in paper, but with only moderate success, as 70 per cent of the wall plaster used in this country is still shipped in jute. To reduce breakage the content of the paper container is limited to 80 lb., requiring the use of twenty-five bags for each ton of plaster. When gypsum plaster is shipped in paper an extra charge of $1 to $1.50 per ton of plaster is charged for the bags, and such bags are not redeemed. When shipments are made in paper, car floors and sides must be lined with felt paper or old burlap to prevent perforations, and twenty-five or more empty bags are sent with each car to cover the bags broken in transit.

The American Society for Testing Materials has adopted as standard the following specifications for calcined gypsum:

STANDARD SPECIFICATIONS FOR CALCINED GYPSUM

Serial Designation; C 23.-22

These specifications are issued under the fixed designation C 23; the final number indicates the year of adoption as standard, or in the case of revision, the year of last revision.

Proposed as tentative, 1919. Adopted in amended form, 1922 Materials and Standards.

Testing

1. The chemical and physical properties of calcined gypsum shall be determined in accordance with the Tentative Methods of Testing Gypsum and Gypsum Products (Serial Designation; C 26-21T) of the American Society for Testing Materials.

Definition

2. Calcined gypsum is the product resulting from the partial dehydration of gypsum by means of heat.

Sizes

3. Calcined gypsum may be marketed in either of the folowing sizes;

No. 1.—Material of this size shall all pass a 14-mesh sieve, and not less than 75 per cent of it shall pass a 100-mesh sieve.

No. 2.—Material of this size shall all pass a 14-mesh sieve, and not less than 40 nor more than 75 per cent of it shall pass a 100-mesh sieve.

Note.—A tolerance provision of 1 per cent on all sieve determinations is permitted.

Fineness

4. Calcined gypsum may be marketed in any of the sizes enumerated for calcined gypsum in Section 3. Each package or each shipment, shipped for resale, shall be accompanied by a tag or card which shall contain the information required by Section 10.

Time of Setting

5. (a) The time of set of calcined gypsum shall be suitable for the purposes intended, and shall conform to the provisions prescribed for such in the Standard Specifications for Gypsum Plasters (Serial Designation; C 28) of the American Society for Testing Materials.

(b) Calcined gypsum for molding or casting shall set in not less than ten minutes nor more than forty minutes.

Tensile Strength

6. (a) Calcined gypsum shall have a tensile strength of not less than 200 lb. per sq.in. (14 kg. per sq.cm.).

(b) Calcined gypsum for molding or casting shall have a tensile strength of not less than 200 lb. per sq.in. (14 kg. per sq.cm.).

Compressive Strength

7. (a) Calcined gypsum shall have a compressive strength of not less than 1,000 lb. per sq.in. (70 kg. per sq.cm.).

(b) Calcined gypsum for molding or casting shall have a compressive strength of not less than 1,000 lb. per sq.in. (70 kg. per sq.cm.).

Sampling

8. At least 3 per cent of the packages shall be sampled, and shall be so selected as to be representative of the contents of the shipment. Samples shall be taken from both the surface and the center of the packages. The material so obtained shall be thoroughly mixed and reduced by quartering to provide not less than a 15-lb. (6.75 kg.) sample for the laboratory.

Laboratory Samples

9. All laboratory samples shall immediately be placed in an air-tight container and shipped to the laboratory for test.

Packing and Marking

10. Calcined gypsum may be shipped in either packages or in bulk.

(a) When shipped for resale, the following information shall be legibly marked on each package or on a tag of suitable size attached thereto:

Name of manufacturer;
Brand;
Description;
Net weight of package.

(b) When shipped in bulk, a card containing the required information shall be conspicuously placed in the carrier.

Inspection and Rejection

11. Inspection may be made either at the point of shipment or at the point of delivery. The inspector representing the purchaser shall have free access to the carriers being loaded for shipment to the purchaser. He shall be afforded all reasonable facilities for inspection and sampling, which shall be so conducted as not to interfere unnecessarily with the loading of the carriers.

12. Any rejection shall be based upon the specific cause of failure to conform to the requirements of these specifications and shall be reported within ten working days from the receipt of the shipment by the consignee.

13. Claims for rehearing shall be valid only if made within twenty working days from receipt of notice of specific cause for rejection.

Tentative specifications for gypsum wall plasters, gypsum tile, and gypsum wall board have been published by the American Society for Testing Materials, but since these specifications are of considerable length, and the fabricated gypsum articles carry the reader somewhat far afield from gypsum as a mineral, these specifications will be passed over merely with the statement that they may be found in the Society for Testing Materials Tentative Standards.

The Value of Gypsum

Crude gypsum, carlots, for cement mill use is today quoted at from $3 to $4.50 per ton, the higher price prevailing at points where production costs are high. Calcined gypsum, carlots, is selling for $8 to $10 a ton, bags extra, as explained above.

Neat gypsum wall plasters, carlots to dealers, are today quoted at $10 to $12 a ton, bags extra. Sanded wall plasters sell for a lower price than neat plaster, for the reason that they carry a relatively inexpensive filler in the form of two or more parts of sand to each part of gypsum plaster.

A word of caution should be added for the benefit of any one who is studying the gypsum plaster business, with reference to cost figures set out in two or three publications, which in other respects are reliable. The quotations usually given are wide of the mark in connection with overhead (including selling) expenses, depreciation, and amortization. In certain cases no distinction has been made between the costs of calcined gypsum and neat gypsum wall plaster. The difference in the cost of these commodities averages more than a dollar per ton.

The following figures showing output of gypsum and gypsum products in the United States in 1922 were compiled by the U. S. Geological Survey:

Number of active plants reporting	64
Total quantity mined, tons	3,779,949
Sold without calcining:	
Agricultural gypsum, tons	101,904
For portland cement and paint, tons	668,821
Sold calcined, tons	2,491,265

The material sold calcined was distributed among the following products:

Calcined	Short Tons	Value
Stucco	396,990	$2,813,561
Neat plaster	1,333,261	12,126,811
Sanded plaster	80,455	1,165,771
Mixed plaster	*(a)*218,650	*(a)*1,914,572
Plaster of paris, molding and casting plaster	*(b)*126,288	*(b)*1,198,819
Keenes cement	21,991	324,316
Plaster board	42,088	945,171
Wall board	120,591	4,500,725
Partition tile	68,338	915,449
Roof tile	*(c)*	*(c)*
Special tile or blocks	44,834	368,068
Other purposes	37,779	644,542
Totals	2,491,265	$26,917,805
Crude	770,725	2,443,346
		$29,361,151

(a) Includes small quantity of wood fiber plaster. *(b)* Includes dental plaster and plaster sold to plate glass makers. *(c)* Included under "Other purposes."

The difference in figure for total tons mined and the sum of the figures for tons sold crude and calcined is due to the 16 per cent shrinkage during calcining.

The months of December, January, and February are low production months, due to the slackening of demand from cement mills and the slowing up of building operations. The high points in production occur in May, June, and September.

The behavior of gypsum plasters when mixed with the great variety of sands that are used with such plasters throughout the country may fairly be considered a special marketing problem. A gypsum plaster that is eminently satisfactory on one market may not please the plasterer who applies it on another. The fact must be recognized by any one who considers entering the gypsum plaster business, that the man that he must please primarily is not the architect or the owner but the workman who applies the plaster. The architect and the owner must be considered, it is true, but if his plaster makes the best and the hardest wall, and still pulls a little harder on plasterer's arm as he applies it than another brand that is available, the plasterer will in the majority of cases be the person who determines the brand of plaster that will be used.

The contractor also is interested in maximum yardage or spread, and the tendency to oversand gypsum plasters must be recognized. The proper amount of sand to use with gypsum plasters varies with the quality of the sand and the nature of the background. The following specification for a standard plastering sand has been tentatively adopted by the A.S.T.M.:

Sand used for plastering purposes in which a gypsum plaster is employed shall be free from salt and from alkaline, organic, or other deleterious substances. It shall be graded from fine to coarse, and when dry not more than 10 per cent by weight shall be retained on a No. 8 sieve; not less than 80 per cent by weight shall be retained on a No. 50 sieve; and not more than 6 per cent by weight shall pass a No. 100 sieve. These sieves shall meet the specifications given by the U. S. Bureau of Standards' Standard Screen Scale.

At present the line of most rapid expansion in the industry is found in connection with the manufacturers of gypsum wall board. Gypsum boards are rapidly replacing fiber boards, their superiority as a non-shrinking, fire-resisting wall surface being easily demonstrated.

USEFUL OPERATING IDEAS

Comparing Oil Fuel and Coal Costs

By W. F. Schaphorst

One of the troublesome questions for fuel users is, Will it pay to burn oil instead of coal? So many conditions apply that a direct answer is difficult. Much depends upon these conditions. Oil is already being burned under many boilers, and its use appears to be satisfactory. Some engineers are opposed to the use of oil, and other engineers are in favor of oil burning. However, the oil vs. coal question should be carefully considered for every plant that has difficulty in obtaining coal and where a high price must be paid for coal. The accompanying chart will assist in answering the question.

To use the chart it is necessary to zigzag across as indicated by the dotted lines. Column G, which is indicated by the letter at the bottom, gives the number of B.t.u. equivalent to each cent's worth of coal or oil purchased. Column G, therefore, applies to both oil and coal.

For oil, begin at the left and zigzag toward the right to Column G. For coal, begin at the right and zigzag toward the left to Column G. If the oil, for instance, contains 20,000 B.t.u. and its specific gravity is 0.9 and, if the boiler efficiency with oil fuel is 80 per cent, the zigzag dotted line drawn across the chart from Column A to Column G through these respective figures shows that each cent will buy 24,000 B.t.u. Begin at 5c., the assumed cost of oil per gallon, Column A, and extend a line through the 80 per cent, Column B. This intersects Column C. From the intersection extend a line through 20,000 B.t.u. per pound of oil, in Column D to its intersection on Column E. From the last intersection extend a line through the 0.9, Column F, and the final intersection with Column G then gives the answer—24,000 B.t.u. for each cent.

For comparison with coal begin at the right. If coal costs $8 per ton of 2,000 lb. and if the boiler efficiency using the same boiler is 70 per cent with coal, and if each pound of coal contains 11,000 B.t.u., each cent will buy about 19,200 B.t.u. as shown in Column G.

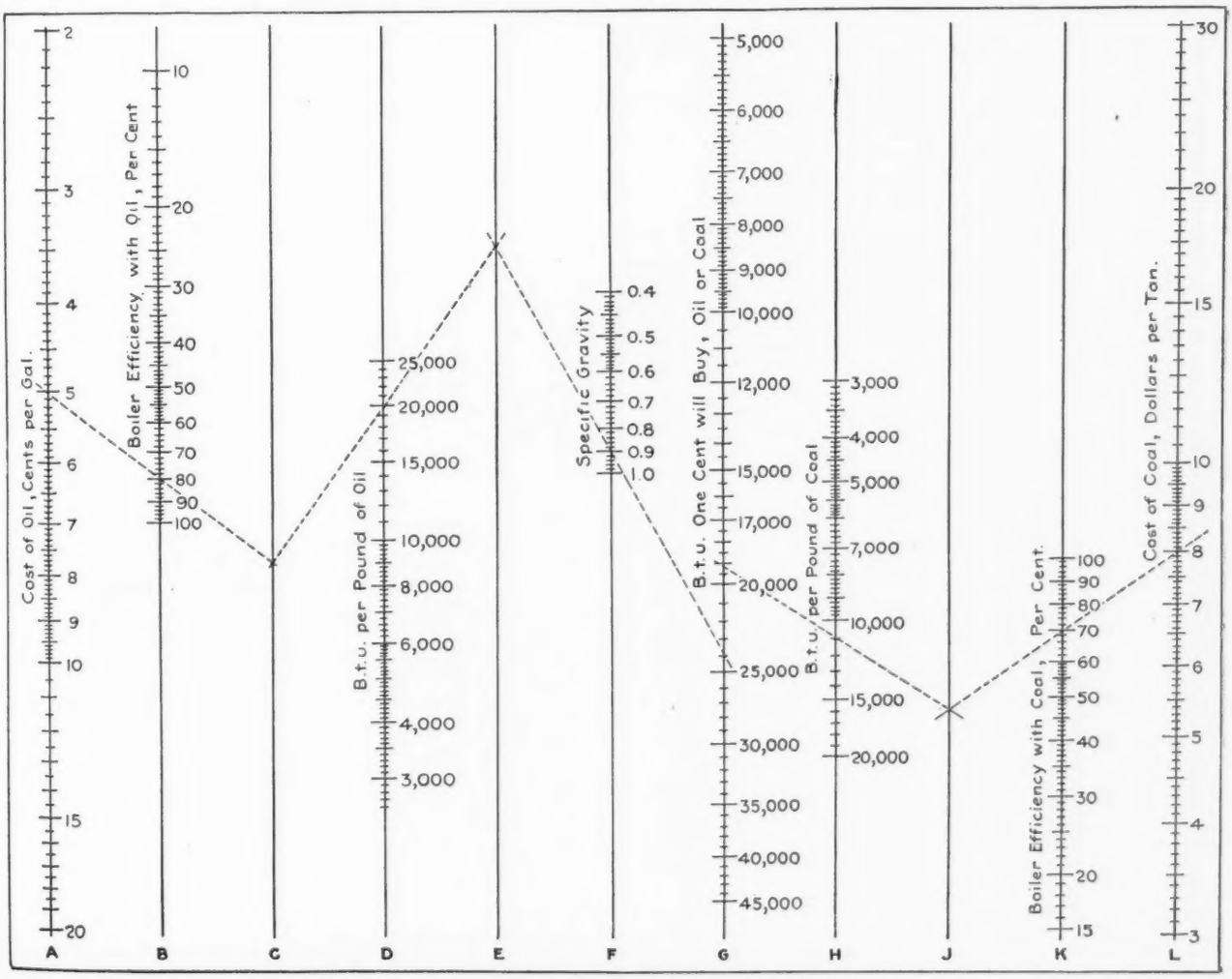


Chart for comparing cost of coal and oil for fuel purposes

Useful Operating Ideas

As will be noted the $8 is found in Column L and the 70 per cent boiler efficiency is in Column K. Extend a straight line through both points and locate the intersection in Column J. Then from this intersection extend a line through the 11,000 in Column H and the intersection with Column G gives 19,200 B.t.u. The solution of this problem indicates that the use of oil at 5c. per gallon will furnish nearly 5,000 B.t.u. more for each cent than will coal at $8 per ton. In using Column A the cost per gallon should include all costs—cost of hauling, cost of storing, and other items. Boiler efficiencies with oil fuel are usually greater than with coal. The difference is often as much as 10 per cent, as indicated in this problem, where 80 per cent in Column B and 70 per cent in Column K are the figures selected.

An easy way in which to determine the specific gravity of oil is to take any vessel, such as a bottle, and weigh it. Then fill it with water and weigh again. Subtracting the weight of the vessel gives us the weight of the water. The weight of an equivalent volume of oil is found in the same manner. Divide the weight of the oil by the weight of the water. The quotient is the specific gravity. Where a sample of the oil is not available and the density of the oil is given in degrees Baumé, the accompanying table will be found useful in connection with Column F.

To calculate the specific gravity, from degrees Baumé, simply add the Baumé degrees to 130 and divide the sum into 140. The quotient is the specific gravity. The cost of coal, Column L, should include all costs such as hauling, storing, pulverizing and rehandling as well as interest on the purchase price if it has been stored any length of time.

Comparison Between Baumé Degrees and Specific Gravity

Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity
10	1.0	55	0.76
15	0.97	60	0.74
20	0.93	65	0.72
25	0.90	70	0.70
30	0.88	75	0.68
35	0.85	80	0.67
40	0.82	85	0.65
45	0.80	90	0.64
50	0.78	95	0.62
..	....	100	0.61

The chart may be used in several ways for solving various problems. Thus by zigzagging clear across from left to right from Column A to Column L, knowing the cost of oil and all the necessary intermediate factors, Column L gives the equivalent cost of coal. Or zigzagging toward the left from Column L the equivalent cost of oil is obtained. Thus with coal at $6 per ton and a boiler efficiency at 70 per cent a heat value of 10,300 B.t.u. per pound of coal would give no economic advantage. Oil has, however, other advantages such as less labor required for firing, less storage space and greater convenience in use. All of these points, including particularly availability of supply, must be given consideration before one can decide that oil should be used for fuel purposes in preference to coal, or otherwise.

Protecting Workmen from Blasts

By R. Franklin Mundorff

To protect workmen from flying rock resulting from blasting, oak houses and old sections of steel tanks are used in various mine and quarry operations and their use results in saving money which formerly was paid for the lost time that was spent in going to and from some distant place of safety when blasting. It is customary for the men to go from one-eighth to one-quarter of a mile to safe positions. The cylindrical steel tank can be placed within 100 ft. of the blast. In this instance the steel tanks consist of sections of old rock driers that are closed at one end by a double thickness of 2.5-in. oak lumber. Each steel tank will accommodate fifteen workmen. The tanks can be easily rolled from place to place and thus may be kept near to the groups of workmen.

V-shaped houses designed to accommodate ten workmen and constructed of 2.5-in. oak timber have also been used. The V-shaped houses are, however, more cumbersome to handle and cannot be placed as close to the blast as the steel tanks. Both types are in use at the quarries of the Louisville Cement Company at Speed, Indiana.

Shelter of oak that will accommodate ten men during blasting

Shelter for workmen made from section of old rock drier

Americanization of Miners, and Others

By T. A. Rickard

THE DEVELOPMENT of aliens into citizens is a nation-making process that, it is pleasing to note, is engaging public attention in our mining districts, as elsewhere. Indeed, the alien character of the mine workers has become increasingly marked during recent years; at the coal mines east of the Missouri River this fact was accepted long ago, but even in our western metal lines a complete change in racial character is evident.

This change has been successive. Forty years ago our metal miners were usually Cornish and Irish, with a considerable sprinkling of native-born Americans. All spoke the same language. Within ten or twenty years the Finns became numerous in the mines, and with them immigrants from the neighboring parts of Scandinavia. The peoples of northwestern Europe became an important source of mine labor, but the Cornish and Irish were still at work, and the native American did his share. To these were added the Piedmontese, excellent hard-rock miners. Shortly before the war large numbers of Serbs, Montenegrins, Austrians, and others from southeastern Europe came to our western mines. They were more distinctly alien than those whom they replaced; they were slower in learning to speak the language of our country and they herded together. During the war an increase of Slavs, Greeks, and also of Spaniards became manifest. When the copper mines were shut down in 1921 they lost many of their former workers, who, especially in the Southwest, were replaced by Mexicans, not American born, but from over the border. At several Arizonan mines, notably the Ray and the United Verde Extension, nearly all the miners are Mexicans. At Ray they were introduced after a strike of the previous workers, and they are living in a separate settlement known as Sonora. In other districts also the tendency is for the Mexicans to herd together; indeed, it must be said frankly that most of the foreigners like to live near their own kind, and any locality in which this comfort is denied them is unattractive to them. The effect of such grouping, of course, is to delay their assimilation and Americanization, because, among other things, it decreases the urge to learn English. In most of the mining districts there exist night schools for the purpose of correcting this deficiency, but there is no way of compelling the workers to acquire the language, so that progress is slow.

Apparently something ought to be done, by legislative enactment, compelling the alien to learn our language within a reasonable period, on pain of deportation, for, after all, no Americanization is possible without this first step. The danger of working underground, it need scarcely be remarked, is increased by the inability of men and foremen to speak the same language. Another result is to discourage our native young men from working in the mines; because the difference of language is a barrier to understanding. The time was when a young American could work alongside a kindly old Cousin Jack, or one of his own people, who could, and would, teach him what to do. Apprenticeship was pleasant under such conditions. Today the novice has to work with an alien with whom he cannot talk, and who, as the manager of a celebrated mine said to me, will blow garlic in his face.

Moreover, who can blame the intelligent worker if he leaves the underground workings of a metal mine for the sunlit surface of an oil field, or prefers construction work in southern California to thumping a drill in a dark hole in Arizona? If that be so, and if the work in the mines is to be done by the newcomers from foreign lands, then surely it is high time to face the position and establish such a system of language-teaching and Americanization as shall make them efficient employees and intelligent citizens. This leads to a wider discussion of the subject.

The war, and the events that preceded our participation in it, made us, as Americans, conscious of the diverse origins of the people of the United States. That consciousness of diversity of origin, in so far as it militated against our solidarity as a people, was one of the worst effects of the war. Since then, owing to the appeals that have come to us from Europe, we have continued to be race-conscious, because the problems of Ireland, Poland, Germany, and France, to mention the more insistent, have made appeals to a sympathy arising in large measure from the traditions inherited by the majority of Americans not yet so far separated in time from the countries of their forefathers as to have lost a special interest in their welfare. That interest, by becoming the cause of controversies among us, is a deterrent to the complete assimilation that every good American desires devoutly. The insistence on Americanization therefore is logical, for it recognizes the fact that integration, by assimilation, and not disintegration, by partisanship in foreign controversies, is essential to the fusing of the diverse racial and national elements that have made a home in the United States.

Americanization is the making of an American, the bringing of men and women into sympathy with the ideals of the American republic. As those born in this country are Americans in fact and in law, the term Americanization implies the conversion of aliens into citizens. How this is accomplished has been related recently by two distinguished men that underwent the process. In "The Americanization of Edward Bok" and "From Immigrant to Inventor" we have been permitted to obtain autobiographically the story of the Americanizing of a successful publisher, Mr. Bok, and of a celebrated scientist, Professor Pupin. Both manifestly brought something that was valuable to the country of their adoption; the initiative and aggressive energy of the publisher have left their marks on the manufacturing of magazines in the United States; the genius and engaging personality of the electrician have played a decisive part in the telephone business.

It is amusing to note the difference of mental approach to Americanism shown by the Hollander and the Serbian respectively. Mr. Bok believes that the United States obtained the Declaration of Independence, its Constitution, and a few other items from his Dutch kinsmen; he feels a proprietary interest in the country that gave him his career, but, one must concede, much as his bumptiousness may amuse, that he has proved himself a useful citizen and that in his later life he has shown himself an American in the fullest sense of the word. Professor Pupin's story is romantic; a penniless boy from an obscure village near the Danube, he came to this country when not yet able to speak its

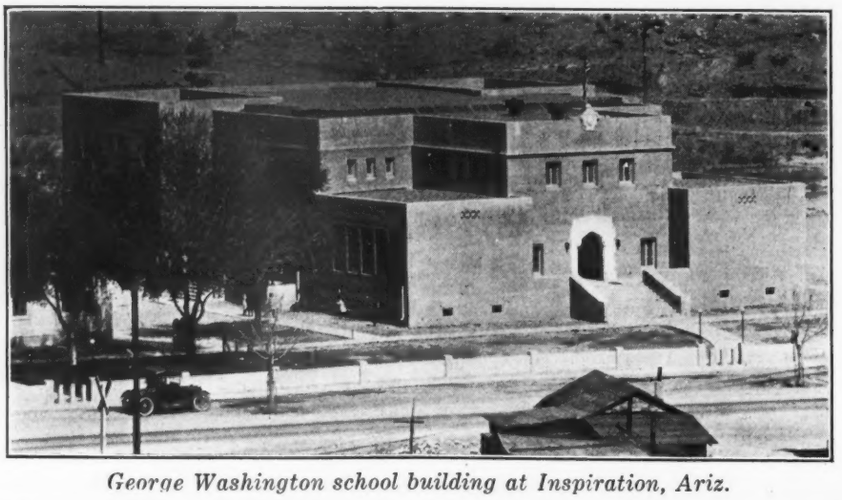
language, but already interested in electricity by reading of Franklin's experiments, and attracted to the American idea by Franklin's character. He worked his way through college, which was Columbia, where today he is a distinguished professor. He idealized America when yet tending cattle in the Banat, and he continued to idealize it in the after years, when many honors were conferred upon him. He says frankly that the certificate of naturalization seemed to him a greater winning than the diploma of graduation from college. In the Americanization of Michael Pupin, as in that of Edward Bok, it is manifest that the alien gives as well as takes; that the honorable traditions and stimulating ideas of an intelligent foreigner may enrich our heritage as Americans without in any way prejudicing the development of our own civilization.

To make the best of the alien it is necessary to employ two processes, education and naturalization. The latter, which is a legal formality, is of no avail in turning an alien into a good American citizen unless he has been so educated as to understand and love the ideas and ideals that have leavened the lump of American nationality. This nation consists of men and women who themselves or whose progenitors came from foreign countries. They have become united and assimilated by sharing the same experiences; by fighting for their freedom; by battling among themselves over great principles. They have been fused by living and working together, by sorrowing and rejoicing together, by thinking and dreaming together. They have been made into one nation, separate from any other and unlike any other. This unlikeness is the essence of Americanism; to it the inhabitants of the United States owe their identity as a people, upon it they base their ways of living—that is, their civilization. In order to maintain and develop this civilization, this American way of living, with all that it connotes in the conduct of domestic, civic, and national affairs, it is necessary that the incoming foreigner—the immigrant—shall not remain an outsider, extraneous to the spirit of the country.

As Theodore Roosevelt said, this must not be "a polyglot boarding-house"; it must be a home in which all those under the same national roof shall understand each other and work together in harmony for the good of all. Therefore the newcomer should acquire the habits and share the aspirations of the American citizen. First of all, he must learn our language, for without that he remains outside the pale; next he must become informed concerning the Constitution, laws, and system of government under which he expects to live; then he had better learn to play some of the games that we play, for thereby he may find a way to comradeship. The success of this educative process will depend not only upon him but also upon those who undertake to teach him. There must be mutual sympathy. No mechanical method will suffice. The foreigner must want to become Americanized, and we must make it evident to him that we desire to help him in his graduation to citizenship. In short, Americanization is a sympathetic process whereby a foreigner, ceasing to be an alien, becomes a fellow citizen with the direct inheritors of the American tradition.

Attention has shifted of late from the Custom House to Ellis Island, and it is well that the human imports should be scanned as carefully as the other materials exported to us from foreign lands. The destiny of the United States depends upon the ingredients that go into its melting pot, the temperature of which must be kept at a high point, effective for fusion, not merely for agglomeration. The payroll of the Nichols Copper Co. at one time, recently, carried the names of workers representing not fewer than eighty-two foreign principalities and provinces. But we need not be unduly anxious about the diversity of the racial elements, provided they be of the white stock, for the other peoples, now so completely differentiated into what we call—unscientifically—"races," are as composite as our own. For example, we regard the English as a clean-cut racial type, but a mere dip into history will tell us that they represent an extraordinary mixture, not only of Celts, Angles, Saxons, Picts, Scots, and Normans, and not only of refugees from every land, but of the descendants of the legionaries who during the four centuries of Roman occupation were recruited from Asia Minor and the Levant.

National purity of race usually is a fiction, as any inquiry into the origins of our European friends will disclose. So we need not be alarmed at our own heterogeneity, but we must recognize the essential fact, that the welfare of the nation, its intellectual progress and social development, depend upon the assimilation of its diverse elements—that is, upon successful Americanization.



George Washington school building at Inspiration, Ariz.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Assaying for Platinum

Some Alleged "Fake" Results May Have Been Honest Mistakes—Residue Taken for the Metal in Many Tests Proved to Be Vanadium

THE EDITOR:

Sir—I have noted from time to time in the *Journal-Press* and other publications articles on the occurrence of platinum in ores and rocks in various localities, and the pronouncement of fraud, etc., upon these claims by the Bureau of Mines and others, who have contributed exposés of the methods of assay employed by some of the ones who are foremost and persistent in claiming that platinum occurs in the ores under question. I noted more particularly the description of the methods of assay employed by the Philadelphia assayer as well as those of Johnson Bros., and R. A. Dozier, of Grants Pass, Ore., published recently in your columns.

I do not believe that all the assays and claims of the existence of platinum in the various localities are primarily intentional fakes, but honest mistakes due to the inability of the average chemist or assayer to prove his work and his lack of knowledge or experience with the rarer elements.

The methods employed by chemists and assayers at large to determine platinum vary and a variance of results is obtained according to how closely procedure is followed. The methods remind one of the statement in a recent editorial in your columns on assayers and assays, namely: "Sometimes the assayer works by cook-book recipes, as it were, handed down by his predecessor, and if the ore changes little, the results will usually pass unchallenged."

I have not noted at any time any attempt on the part of the Bureau of Mines and the other critics to point out any possible errors of procedure or any reason why so many assayers get erroneous results. It is no evidence of superior knowledge on the part of the Bureau of Mines assayers and chemists over and above that of many of the public assayers and chemists when they fail to substantiate the presence or absence of platinum in any of the ores or minerals suspected of carrying it, and upon their failure to find it to pronounce a fraud with implied intent to commit.

The object of this communication is to relate interesting experiences of my own in the platinum field and point out the possible source of error and how to avoid it. The deposits suspected are near Ruffin, N. C.

In 1912 I met, through mutual acquaintances coming to my office in New York City, one John Lord, an old time western miner, who had wandered into North Carolina about 1902 and become attracted by some platinum discoveries which he stuck to with all faith, spending his money and time, and encouraged all along by assays showing platinum made by very reputable assayers. It fell to my lot to disillusion him in 1919.

Mr. Lord told me his story, as follows: About five years previous to 1902 someone who was interested in fertilizer sent a sample of the schist to a Dr. Wilson, of Baltimore, Md. Dr. Wilson knew on sight it was not in any way valuable for fertilizer. The schist being uniformly impregnated with small quantities of iron and copper pyrites attracted the attention of an employee of Dr. Wilson, by the name of Walch, who did some experimenting on the rock and discovered the presence of platinum and called Dr. Wilson's attention to it. Dr. Wilson then wrote to the fertilizer company for more samples, and a farmer by the name of Hannalson obtained the samples and sent them to Dr. Wilson. These samples, according to Dr. Wilson, assayed 4.76, 2.40, 2.85, and 3.60 oz. of platinum per ton. Then Dr. Wilson sent for more samples, which Mr. Hannalson sent, taking them from the same place, Dr. Wilson got seven straight blank assays, got mad and wrote Mr. Hannalson a very hot letter, accusing him of not acting straight. As a result of the correspondence, Dr. Wilson visited the locality and took samples personally from the places pointed out by Mr. Hannalson, which he took away and assayed, getting results entirely satisfactory to himself, for he shortly returned and excavated a carload of the rock and shipped it to the Mecklenberg Iron Works at Charlotte, N. C., where it was crushed and concentrated 30 to 1, and a series of assays of the concentrates gave the following results, viz: 97.2, 61.2, 42.0, 10.2, 24.6, 25.0, 18.0, and 42 oz. of platinum per ton. These assays were all made by Dr. Wilson, who after working for some months concluded that it might be a long job to work out a commercial treatment for the ore and finally gave it up. He was about eighty years of age, and died shortly after.

The foregoing was the lure which caught Mr. Lord and held him for the following sixteen years. During the year 1902 a man by name of Adams, who was connected with the Consolidated Nickel Co., of Webster, N. C., got in touch with Mr. Lord, and, as a result, extensive assaying was done. Most of the assays were made by an English chemist by the name of Jenkins, employed by the Consolidated Nickel Co. He made twenty-two assays during that time, from March to August, of which one was a blank, three showed traces, and the other eighteen averaged 1.66 oz. of platinum per ton, the highest being 3.92 oz.

During this same period of time, Mr. Adams submitted samples of the rock to a number of other assayers so as to check the work of Mr. Jenkins. He first went to Ricketts and Banks, of New York City, who gave him a blank result, but after some parley and a re-assay using the Jenkins formula they issued a cer-

tificate showing 3.51 oz. of platinum per ton. A sample of same rock assayed by F. F. Hunt of New York City showed 2.60 oz. per ton. Another sample sent to Baker & Co., platinum refiners, of Newark, N. J., showed a trace of platinum. Another sample assayed by M. Trubeck showed 3.10 oz. platinum per ton. Portions of the same samples were submitted to F. F. Hunt which gave a blank result, but which after some parley and reassay by the Jenkins formula showed 3.25 oz. of platinum per ton. Another portion sent to an assayer named Matchett gave a blank result, and another portion, to Ledoux & Co. of New York City, gave a result of 3.07 oz. per ton of platinum. In 1909 two samples were sent to the State Chemist, G. C. Childress, Knoxville, Tenn., which showed 1 and 2.85 oz. of platinum per ton.

When I visited the property of the Consolidated Nickel Co. in 1912-13, I found these results in the assay reports made by Mr. Jenkins and I have seen most of the original certificates of assay of the other results mentioned.

In 1912 Ricketts and Banks gave me space in their laboratory for a friend of mine, who had had experience in platinum assaying and refining, to make some experiments. He reported the presence of the metals of the platinum group to the extent of about 4 oz. per ton.

At the time of my visit to the plant of the Consolidated Nickel Co. I made an effort to determine the presence or absence of platinum in a sample of the rock in question. The laboratory had been practically dismantled and remaining faciliteis were meager. I myself got a residue which weighed the equivalent to 0.37 oz. per ton, and in a concentrate of 70 to 1, I obtained a result of 75.82 oz. of what appeared to be platinum group metals, but failed to hold up to all the tests as far as I was able to carry them because of limited time and facilities.

I tried to get several parties sufficiently interested to make a real investigation, but matters drifted on until early in 1919 a friend of mine who was very much interested in the oil shales of Colorado handed me a piece of oil shale which he claimed assayed $75 in platinum, according to an assayer of Denver, Col. Then he and I visited the platinum schists near Ruffin, N. C., and obtained samples, of which I prepared pulverized duplicate samples and submitted them for assay to John H. Banks & Son of New York, who reported no platinum on all of them, and to Ledoux & Co., also of New York, who reported traces of platinum only. Thus the matter was still in doubt, so I decided the only way to get to the bottom of it was to do it myself and find the nigger in the fence. So I obtained more samples of good quantity and got as far as Washington, D. C., with them and then started to find a place to do my work in. The Bureau of Mines, the Geological Survey and the Bureau of Standards kindly offered me the facilities of their laboratories but none of them had furnaces in which assay fusions and cupellations could be carried on. I was referred to Mr. Frederick P. Dewey, assayer of the Mint, who is the author of a method for determining small quantities of platinum. Recent regulations of the Mint would not permit anyone to carry on work there because of some previous experience when such privilege had been abused, so Mr. Dewey referred me to George Washington University, which had an assay laboratory for instruction purposes. This was turned over to me as well as the chemical laboratory, where I spent a month in the work of determining the absence of platinum in the schists of Ruffin, N. C., and in the sample of oil shale from Colorado.

The officers and faculty of the university were wonderfully kind and courteous in placing facilities and providing conveniences for me. I tried out all the methods of determining platinum and in most instances obtained traces of gold when the assay was made by a primary fusion with lead. I got no results by the Dewey method, but I got a yellow crystalline precipitate with chloride of ammonia, which of course looked like platinum, but when decomposed by heat, the residual supposed metal platinum was soluble in weak acid. To find out what the residue really was I treated a large quantity of the rock so as to get a large enough residue after the precipitation by ammonia and decomposition by heat to examine chemically. The residue I found to be vanadium oxide. Vanadium is the only element outside the platinum group which gives a yellow crystalline precipitate, under similar conditions, of the composition of NH_4VO_3.

Vanadium occurs widely distributed in minute quantites in ores of lead and copper, in clays and basalts, in soda ash, phosphate of soda and some hard coals. Patronite is the principal source of vanadium, associated with iron pyrites and carbonaceous matter. Hence it is most likely to be found commonly in oil shales. Vanadium is so extensively used now in high-speed steels, bronzes for gears, trolley wheels, etc., that the opportunity is quite good for vanadium to contaminate ores or rocks which have been mined and crushed even if it is not originally present in sufficient quantity to give a result equivalent to the one thirty-thousandth part, which is approximately equivalent to one ounce of platinum per ton.

If assayers will take the precaution of testing the solubility of the final residue from the decomposition of the ammonia precipitate with dilute nitric acid, they will determine definitely whether what they have weighed is platinum or vanadium oxide, vanadium oxide being soluble. WILLIAM HUNTLEY HAMPTON.

Portland, Ore.

Radio Underground

THE EDITOR:

Sir—In connection with your editorial entitled "Extending the Use of Radio" that appeared in the Jan. 26 issue, and also with the editorial "Uses of Radio Underground" that appeared in the issue of *Engineering and Mining Journal-Press* of Feb. 16, permit me to call your attention to the fact that you fail, in either case, to make any mention of the tests carried out in Scranton, Pa., on Jan. 17. Unless I am badly mistaken, these tests, conducted by the *Scranton Times* in connection with the officials of the Scranton Coal Co. and the Moon Radio Corporation, were the first ever conducted in a mine and were antedated only a few days by the tests in the new Hudson vehicular tunnel. As the enclosed clippings from the *Scranton Times* of Jan. 18 (portions of which I hope you will have space to publish) show, radio communication was clearly established 400 ft. below the surface, and it was these tests that were given much thought and discussion at the recent convention of the United Mine Workers in Indianapolis.

Scranton, Pa. FRANK J. G. DUCK.

Origin of Ore Deposits

THE EDITOR:

Sir—In my school days, 1861 to 1875, our text books taught as shown by the following citation from a copy of Cornell's "High School Geography," published in 1856: "It is generally supposed that the interior of the earth is in a state of intense heat, and that the surface is a comparatively thin crust produced upon the molten mass by its cooling down externally." The second paragraph of the first lesson of the division of geology in Wilson's "Fifth Reader," of the series of readers used in the public schools of California in my day, and copyrighted by Harper & Brothers in 1861, is a statement of LaPlace's nebular hypothesis of the origin of the earth; while the geological chart at the head of Lesson Four is a graphic representation of the theory of differentiation from a common magma. This text is practically an abridgment of Lyell's "Principles of Geology," then a one-volume edition.

By the time I had reached manhood, it was a settled conviction with the majority of the miners and prospectors that the coarse gold of the placers and the rich pocket gold from the quartz veins was of "volcanic origin." This conclusion was to be expected as a corollary of the accepted theory of the earth's cosmogony, as laid down by the text writers of that day, and which is the foundation upon which the early-day prospectors built their theory of "the true fissure vein, and increase of values with depth." Work in the field soon taught them that the quartz veins were all closely related to the great "porphyry belts," and that mineral-bearing veins were not found outside of them, so that in time the prospector began to stress "formation." As a boy it was my privilege to talk with the early-day miners and prospectors, not as a boy, but as man to man with equals, willing to give of their knowledge and experience, without money and without price, desirous of weighing their theories in the balance of discussion; and I have no recollection of hearing any of the early-day men advance the aqueous theory of fissure filling. Just when the hypothesis of aqueous fissure filling was advanced on the Pacific Coast I am unable to state, but I think it began to be discussed in the cabins and round the camp fires about 1876, but gained no vogue with the older school of miners and prospectors until about the time I came to Idaho in 1895, when the controversy over the two theories was at its height, with the proponents of the aqueous hypothesis gaining the ascendency.

I could never accept the aqueous theory of ore genesis, because I believed it to be based upon insufficient evidence, and also because it did not offer a satisfactory solution to the problem of the origin of the nugget gold of the placers and the pocket gold of the quartz veins. The fundamental weakness of the aqueous theory of vein filling is that undue weight has been given by its proponents to the travertine deposits of mineral-bearing springs and the circulating waters of mine workings; and to the reactions of hydrometallurgy; and that they have evidently disregarded smelter reactions. The soundness of the theory of quartz-vein orebodies being primary deposits crystallized out of a molten magma to my mind is unquestioned. It is my belief that all native metal deposits have been crystallized from the common magma near the line of contact between the sedimentary rocks and the underlying granite, for I think it is an indisputable fact that the majority, if not all, of the deep gold mines of the world are found in the sedimentaries, and in veins of a comparatively flat dip, and that the nuggets of gold and platinum of placer diggings are the size and shape of the vug or crevice in which they were cast at the moment of freezing. No extensive placer deposits of nugget or coarse gold have been found outside of the limits of glacial erosion. It is my impression that the southern limit of the coarse gold placers of the Pacific Slope is Mariposa County, Calif. My experience and observation are to the effect that the gold of the Pacific Slope placers has been transported from its original matrix by moving bodies of ice. Moreover, no nugget gold is found in placers formed from erosion of veins in a granite matrix. My studies of the genesis of platinum deposits are in accord with this conception of gold deposits. It seems to me that the text writers on geology have overlooked the dissimilarity between orebodies in sedimentary rocks and those in granite.

For my own guidance I have formulated the following rules:

1. That fissures are formed from the bottom upwards and that included fragments of porphyry or country rock enclosed in orebodies are splinters sloughed or broken off from the sides of the opening fissure, analogous to those formed in splitting a stick of wood.

2. That fissuring and fissure filling are paragenetic; that is, as the fissure opens from below the mass of dike matter is injected into it.

3. That all metal-bearing deposits are crystallized out of the common magma, and paragenetic with it.

4. That deposition from water is a secondary reaction and limited in extent.

5. That the ribbon structure of silica is the result of pressure during the process of cooling.

6. All fissures are undulating or serpentine along a course of general strike with lens-shaped swells at intervals along the strike of greater or less size; that it is in these swells that orebodies are to be found; that between the swells or lenses the fissure is, as a rule, simply a line of fracturing; that these lens-shaped zones are chimneys or shoots into which the orebody has been injected.

7. That ore deposits have been differentiated from the common magma at profound depths; this hypothesis being based on the fact that the majority of quartz veins parallel the great igneous dikes or extrusions always found cutting the country formation in mining regions.

8. That the horses and boulders found in quartz veins are splinters or fragments from the walls of the fissure, and are broken off the walls as the fissure opens, and that those with sharp edges have sloughed from the hanging wall and fallen into the viscous mass as it neared the freezing point.

9. That orebodies are formed at or near the line of contact between the sedimentaries and the underlying granite, and that the main body of the ore lies above the contact line.

Finally the magmatic theory, as propounded by J. E. Spurr, offers the only reasonable solution of the problem of the genesis of the copper and chrome iron deposits of northwestern California and southwestern Oregon.

HENRY S. HAZLITT.

Dixie, Idaho.

THE MINING NEWS

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Summary of the Week

NET earnings totaling $8,924,581 are reported by the American Smelting & Refining Co. as the result of its operations during 1923. This is the best showing in any year since 1917.

At Anyox, B. C., the new 1,500-ton copper concentrator of the Granby Consolidated Co. is ready to start.

John D. Ryan in explaining the passing of Anaconda's dividend declares that income from Chile Copper and American Brass exceeded the interest on the bond issues and that the condition of western mining operations made the omission of the dividend advisable.

Lead mining in southeastern Missouri is especially active under the stimulus of high prices for the metal.

A conference to discuss wages with mine and smelter workers at Butte ended with the definite refusal of the companies to consider an increase.

Senator Oddie has drafted a bill to provide additional funds for paying War Minerals Relief claims.

Reduction of operations to a five-day instead of a six-day week is announced by the Calumet & Hecla in Michigan. On Jan. 1 the company had 40,000,000 lb. of copper on hand.

Encouraging progress in the treatment of complex lead-zinc ores is reported by metallurgists of the Bureau of Mines and the Utah School of Mines.

Bullion shipments from Tonopah show a definite increase in production of silver ore from the Nevada camp.

Hercules interests have obtained control of the newly developed Stratton property in the Coeur d'Alene.

Four Arizona copper companies are in position to expand current copper production when it seems advisable.

Southeast Missouri Booms Under Stimulus of Lead Market

National Lead Co. Again at Full Capacity—Ford Interests Active—Annapolis Output Grows

The Southeast Missouri lead district is operating at top speed, as, under the stimulus of 10c. lead in the St. Louis market, the profits in the district are unusually high. Though there is no shortage of labor, everyone looking for work is employed, and more men would be put to work if available. Wages were advanced 10 per cent last week, which restores them to the top notch paid during the war period, when for a short time lead sold at 12c. in St. Louis.

The National Lead Co. is again running at full speed, as it has restored the crushing plant that was destroyed by fire last November. Its new shaft on the Pim lands, near Elvins, is opening up a large body of good grade ore. This makes a very important addition to the output from the deepest shaft in the district—nearly 800 ft.

The Ford interests are increasing their force and have a number of drills in the district testing out a small portion of the large acreage they hold under option. They now have six drills at work and are expecting additional machines. They have also opened a local chemical laboratory for assaying cores.

How Far Will Curtailment in Copper Production Go?

FOLLOWING the announcement on the part of the Calumet & Hecla and Inspiration Consolidated Copper companies, that mining operations at their properties will be suspended one day each week, rumors are afloat that several other important producers will take some action toward curtailment of current output. Anaconda and its satellite, Greene-Cananea, are expected by many to take the step in an effort to cut the production rate to correspond more nearly with consumption.

The Annapolis Lead mill, in Iron County, is being remodeled, and its output is steadily growing under the direction of the new manager, Arthur Thacher. The output is 500 tons a day; it is planned to build it up to 700 tons, which is the maximum capacity of the mill.

Jib Consolidated Starts Mill

The Jib Consolidated Mining Co. has turned over the first unit of its concentrating plant at Basin, Mont., and is now treating 150 tons per day. The second unit of 150 tons will be started later. The plant is treating ore containing gold, silver, lead, and iron from the Hope and Katie mines.

Tonopah Bullion Shipments Indicate Improved Conditions

Fifteen-Day Run Returns $181,500—Tonopah Extension Production Largest for Many Months

Bullion shipments from Tonopah, Nev., for the first half of February indicate a gain over the recent rate of output of about $50,000 per month. The Tonopah Extension shipped 110,330 oz., valued at $88,000, the West End 46,463 oz. valued at $39,500, and the Tonopah Mining Co. 63,000 oz., valued at $54,000. This makes a total of 219,793 oz., valued at $181,500, covering operations for the first fifteen days of February.

Tonopah Extension production for January was the largest for many months. The mine produced 13,500 tons of ore, bullion was valued at $178,722.56, and net profits were $49,613.45, which is about double the rate of profit for the last several months. This company reports development of large tonnages of good ore, in various veins, on and above the 2,000 level, and the average grade of the ore is said to be above that mined on the 1,880 and higher levels. Shaft sinking below the 2,000 level is planned.

The Belmont reports that the new vein being developed on the 1,000 level continues to show from 4 to 5 ft. of high-grade ore. The east drift is out over 200 ft. The crosscut on the 900 level has not yet reached the projected position of the vein.

Calumet & Hecla Curtails to Five-Day-Week Production Basis

Will Let Subsidiary White Pine Mine Fill With Water—Idle but Drained Since 1920

Calumet & Hecla's decision to operate five days a week instead of six, which became effective March 3, will reduce the company's refined copper production approximately 1,000,000 lb. monthly. Of the total, the conglomerate department produces 3,000,000 lb., the reclamation plant, 1,500,000, and Ahmeek, 2,300,000.

The company ended 1923 with about 40,000,000 lb. of copper on hand, and this surplus, coupled with metal market conditions, probably prompted the curtailment. More than 3,000 men are affected by the change in the working program at mines and plants, and the monthly saving in wages to the company will be over $50,000.

None of the other companies in the Michigan copper district has announced any curtailment policy. Refined copper production of all the producing mines in the district in February was 12,565,000 lb., estimated.

The White Pine mine, in Ontonagon County, one of Calumet & Hecla Consolidated's subsidiaries, which has been kept pumped out since its shutdown in November, 1920, is now being permitted to fill with water. Pumps and pipe lines and other equipment have been removed to prevent deterioration. It probably will be some time before this property is reopened, depending entirely on metal market conditions. In 1920, the last year the mine was operated, about 1,900,000 lb. of refined copper was produced, at a cost of nearly 14c. per lb. White Pine has two working shafts, Nos. 3 and 4, of comparatively shallow depth, No. 3 being 1,090 ft. deep and No. 4, 978 ft. Copper values are well distributed, but the copper is flaky and requires flotation treatment. The yield is good, averaging nearly 20 lb. of refined copper to the ton of rock milled.

Mine Development for 1923 Cost $677,440 in Bonner County

According to a compilation made by the Idaho Mining Association, companies operating in Bonner County spent $677,440 in 1923 on non-producing and non-dividend paying mines. The statement in detail is as follows: On non-producing properties, labor $161,460, supplies $68,100, machinery $3,300, new mill construction $92,250, power plants $79,130. Total $404,240 on non-producing companies. On producing but non-dividend-paying companies, labor $225,000, supplies $36,000, total $261,000. Assessment work on unpatented mining claims at $100 each, $12,200. Grand total $677,440.

Included in the statement are expenditures by the Cyanide Gold Mining, Idaho Gold & Ruby, Idaho Continental, Moyie Gold Mining, International Molybdenum, Boulder Creek Gold Mining, Copper Cliff and other companies, still in the development stage, to the number of fifteen.

A. S. & R. Co. Earned $8,924,581 Net During 1923; Best Year Since 1917

THE American Smelting & Refining Co. reports net income of $8,924,581 available for dividends as the result of its operation during 1923. This is the most favorable record made by the company since 1917, comparing with a net income in 1922 of $5,918,142. After allowing for the regular dividends on the preferred stock there was a balance in 1923 equal to $8.98 a share earned on the $60,998,000 common stock outstanding. In 1922 the company reported earnings equal to $3.28 a share on the common stock.

The detailed statement of earnings for 1923 and 1922 follows:

	1923	1922
Total net earnings	$19,557,000	$14,840,539
Other income	597,914	233,675
Total income	$20,154,914	$15,074,215
General expense, taxes, etc.	2,838,326	1,911,324
Interest, depreciation etc.	8,392,007	7,244,748
Net income	$8,924,581	$5,918,142
Dividends	5,819,806	(a)3,915,030
Surplus of income	$3,104,775	$2,003,11

(a) Preferred dividends only in 1922.

The balance sheet on Dec. 31, 1923, showed current and miscellaneous assets of $86,195,698, against current liabilities of $17,594,766. Current assets included cash and government securities amounting to $20,837,752, accounts receivable $11,791,824, notes receivable $1,119,292 and inventories valued at $38,511,861.

Simon Guggenheim, the president, in a statement to stockholders, said the company was in a strong cash position, not having any outstanding bank loans or other loans. Mr. Guggenheim referred to the resumption of dividend payments on the common stock last year and to the satisfactory sale of the company's mines in Flat River, Mo., to the St. Joseph Lead Co. Commenting on this transaction, he said:

"Steps have been taken to enlarge the company's smelter at Federal, Ill., to accommodate the greatly increased tonnage it will receive under this arrangement."

The report shows that the company is constructing a byproduct coke plant at Rosita, Mexico, and a new copper smelter and arsenic plant at San Luis Potosi, Mexico. The management is active in the acquisition of new mining properties.

Four Arizona Copper Companies Ready to Expand Output

May Be Some Delay on Account of Low Market—Little Curtailment Since Jan. 1—No Labor Shortage

EXCEPT for the shutting down of the Humboldt smelter and a few tributary mines, little change has occurred in mining operations in Arizona since Jan. 1, and production has been maintained at the same rate as during the latter part of 1923. Though it has been evident that many operators have been continuing at a near-capacity scale, with little chance of profit under the existing low price for copper, it is considered to be more economical to operate than to close or curtail and disrupt organizations and entail shutdown expenses until the time of market improvement. Important increases in production at four of the largest mines in the near future would be more certain if the copper market were better. The Magma Copper Co. will be ready to start the new smelter about April 1, and it will make possible an increase in output to about 2,000,000 lb. per month. The finishing parts of the construction are being rushed to completion and an organization for its operation is being effected.

At Morenci, about 1,500 men are now employed by the Phelps Dodge Corporation, a large number being on development of the mine and construction at the No. 6 concentrator. Production from the mines is now being maintained at about 2,400 tons per day, but it is likely that an increase will be made to about 4,500 tons per day within the next two or three months. At this time, the work of remodeling of the No. 6 mill is expected to be completed.

The completion of the new concentrator by the New Cornelia Copper Co. at Ajo places that company in readiness for greatly increasing its output whenever it decides to do so. Leaching operations can be continued as well as treatment of sulphide ores by the new mill. Inspiration Consolidated Copper Co. expects to have the new Porphyry shaft in operation by July 1, and it is possible that an increase in output will be made at this property at that time. Production at other mines of the Globe-Miami district remains at normal. The Ray Consolidated Copper Co. is operating at capacity, producing about 8,000 tons of ore per day from its mines. About 1,400 men are employed at Ray at this time. The operations of Bisbee and Jerome mines are unchanged, and the continued activities of the many leases and small mines or prospects in both these districts is evidence of confidence. Production of lead ore by the Shattuck Arizona company at Bisbee is high.

Though no great shortage of labor is to be observed at the Arizona mines, there are few experienced men available, and many of the operators are continuing "schools" or some form of instruction by which green men are taught the rudiments of mining.

Chile and American Brass Not Anaconda "White Elephants"

Passing of Dividend Explained by Ryan —Denies Reports that Financing of Subsidiaries Caused Action

John D. Ryan, chairman of the board, and Cornelius F. Kelly, president, in a statement to the shareholders of the Anaconda Copper Mining Co., commenting on the omission of the dividend at the meeting held on Feb. 26, say: "During the year 1923 the company earned, as nearly as can be estimated pending the final audit of all closing entries, and the closing of inventories of metals in process, and finished and manufactured products, approximately $8,500,000 in excess of all fixed charges and costs, including depreciation.

"Since the announcement that the declaration of the dividend had been omitted, there has been some comment that failure to act was caused by the fixed charges incurred in the financing of the purchases of the stock of the American Brass Co., and a majority of the shares of the Chile Copper Co. These statements are incorrect. The earnings resulting from these purchases have not only carried the fixed charges incurred in their acquisition, but have paid a substantial amount in excess thereof to your company proper. Without such earnings it is doubtful if your company would have been justified in distributing $9,000,000 in dividends during the last year.

"The directors believe that in omitting the dividend at this time they are pursuing a conservative policy, in view of the prevailing conditions of the copper market. During the first half of 1923 earnings were upon a fairly satisfactory basis, an average price of approximately 14½c. per pound was realized for all copper sold. Since then, due to the increase of production to a maximum output, and the forced selling, largely on the part of custom smelters not directly concerned in either the cost of production or the price realized for the product, the market has been weak, averaging less than 13c. per pound. At this level, with increased wages, taxes, and transportation costs, the margin of profit is narrow, and it is believed that it is better policy, looking to the interest of the shareholders, to maintain the company in a sound condition, rather than to weaken its current position by paying dividends that are not wholly earned from current income.

"Copper is about the only stable commodity selling in the markets of the world at below pre-war prices. We do not believe that it can long continue to sell at the present level. Domestic consumption has doubled since the pre-war period, and any return to normal industrial activity in Europe will furnish the necessary excess of demand over production to cause market prices to advance and reach a level more nearly comparative with that of all other basic commodities.

"The current position of the company is excellent. As of Jan. 1, as nearly as can be estimated, its net current assets amounted to approximately $72,000,000. We believe that only a small addtional increase in consumption is necessary to take up the slack caused by the present rate of production, in order to place the industry upon such a substantial basis as will warrant an early resumption of dividend payments."

Engels Copper Company Completes New Working Adit

The Engels Copper Co., operating in Plumas County, Calif., has completed its long No. 10 adit, which will effect lower operating costs. Connecting raises to the upper levels are being extended as rapidly as possible. It is expected that the raises will be completed in three months. The adit later will be extended further and the ore-body at this level will be developed completely. The record for the year is satisfactory and the lower costs made possible by the new construction should place the property in a good position. During 1923 indebtedness of $270,000 was repaid and $347,387 was spent on development and construction.

Twenty-Stamp Mill and Mine Plant Cost $106,502

According to a statement made by the secretary of the Moore Mining Co., operating at Jackson, Calif., the cost of the twenty-stamp mill and mine plant is as follows:

Assay laboratory	$514.66
Blacksmith shop	1,507.72
Change house	1,508.21
Dwelling house	966.26
Engine house	1,374.73
Headframe	5,608.45
Hoist	6,996.09
Mill building and equipment	50,584.41
Miscellaneous plant items	19,147.83
Office fixtures	413.43
Reservoir	243.20
Retort and furnace	616.50
Sawmill	1,946.97
Switch house	270.36
Tailing dam	6,672.28
Tailing plant	2,273.86
Tramway	5,036.05
Warehouse	721.85
Total cost of plant	$106,502.86

The purchase price of the property is stated to have been $231,740, on which $61,740 has been paid, leaving a balance of approximately $170,000. The mill is operating at 50 per cent capacity and the 800 level is being opened up.

Asbestos Plant for Globe, Ariz., Is Talked Of

It has been reported that negotiations are under way for the construction of a plant at Globe, Ariz., for manufacturing asbestos products. If the plans are successful, this will mean a revival of the mining of asbestos in this section and will furnish employment for many men. The asbestos of Gila County, where are situated the largest deposits in the United States, is long, silky fiber, of unusual tensile strength and clearness and is said to be particularly desirable for weaving into fabric. Another quality that is in demand is the clearness of the mineral, in that it is practically free from iron stains. While all of the mines are now idle, or only little work being done, assessment work has been kept up by owners of claims and repair men and watchmen have been maintained at the properties.

Hercules Owners Get Control of Stratton Property

Day's Fancy Mine Developed on $10 Option Funds—Lucky Speculators Are Happy

Six months ago a sensational strike of lead-silver was made on the McPhillips property, situated near Wallace, Idaho, which was being developed through a novel promotion plan devised by Stratton & Stratton, of Wallace. Briefly this plan provided for the sale of $10 option certificates having the terms plainly printed on the face of each. The purchaser of one of these certificates upon the payment of $10 was entitled to 250 shares in a company to be incorporated provided the development of the property justified such action, and also gave the holder an option to purchase 750 additional shares in the prospective company upon the payment of $20 more, making a total payment of $30 for 1,000 shares.

As development followed the strike it was soon evident that the organization of a company was justified. The Stratton Mines Co. was incorporated and practically all the outstanding options were exercised within the thirty days allowed, and in the meantime the first payment of $2,500 was paid to Peter McPhillips, owner of the property, under the bond held by the Strattons, the total figure being $15,000. A financial statement covering the affairs of the company up to Jan. 15 showed cash in the treasury $21,735.64. Since making the discovery the ore has been followed over 250 ft. and two carloads have been shipped, the first one returning $50 per ton in lead and silver and the second $60. Another car was shipped March 1. In this short period, through initial investments of $10, the hungry prospect known as the McPhillips has been transformed into what has now become known as the Stratton mine.

Announcement has now officially been made that the Day interests, that control the Hercules, have purchased from Stratton & Stratton sufficient stock to give them a majority of the outstanding shares, for which they paid 15c. per share. Backed by this financially strong and successful mining organization, the future of the Stratton as an important producer seems assured. Incidentally the purchasers of Stratton $10 options find their stock which cost them 3c. a share now worth 15c. with a strong upward tendency, and it is no wild stretch of the imagination to see its value reckoned in dollars instead of cents.

Iron-Ore Production Will Be Increased in Southern Utah

The Columbia Steel Co., which is developing the iron ores of Utah and building blast furnaces and coke ovens between Springville and Provo, in Utah County, about 50 miles from Salt Lake City, is preparing for increased production from its iron properties in southern Utah, from which it will supply its furnaces. Ore bins are being built at the mine.

Lake Shore Finds Good Vein in 1,000 Level Crosscut

Tough-Oakes Shaft Will Be Deepened —Crown Reserve Directors Optimistic—Murray-Mogridge Deal Off

The Lake Shore Mines Co., operating in Kirkland Lake, Ont., has completed the cutting of the station at the 1,000 level and has intercepted the No. 1 vein. At this point the ore appears to be as good as on the upper levels, and the crosscut will be continued to cut the No. 2 vein, which is the main producer. It is not known when the new mill equipment will be put in operation, but it is hardly probable that 300 tons a day will be treated until late in the spring.

Recent developments on the Tough-Oakes mine are understood to be favorable, and as a consequence it has been decided to sink the main shaft below 1,200 ft. and open up three new levels.

The Anglo French Exploration Co. has been examining the Lebel Oro property, at the western end of the Kirkland Lake district. No announcement has been made, however, as to whether a transfer of the property will be negotiated. A shaft has been sunk to a depth of 200 ft., and encouraging values are reported from diamond drilling.

At the annual meeting of the Crown Reserve held recently the directors were optimistic regarding the future of the property. A considerable tonnage of commercial ore has been developed, and it is probable that within six months the company will decide to build a mill. Contrary to general expectations, there will be no immediate issue of stock for further financing.

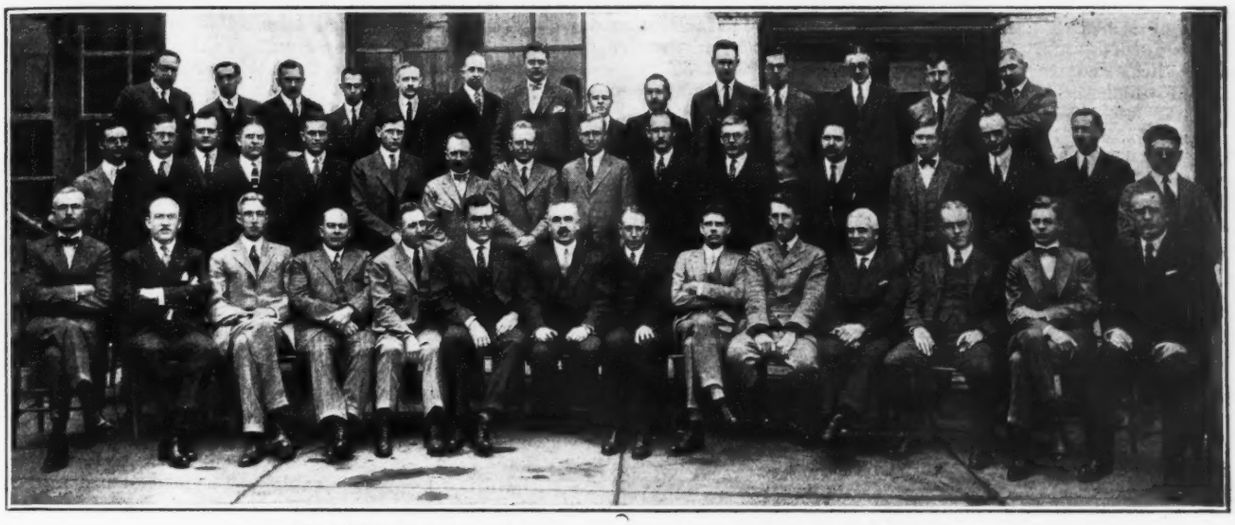
It is understood that the English interests which had an option on the Murray-Mogridge property have decided not to exercise their option on the proposed terms. If a more favorable transaction can be arranged, however, it is believed that the property will be taken over and subjected to further careful development.

Penoles Employees Hold Annual Festivities at Monterey

Fifty employees of the Cia Minera de Peñoles, principal subsidiary and holding company of the American Metal Co. in Mexico, held their third annual get-together meeting at Monterey last January. A banquet and ball featured the event. The company's operations are so scattered in Mexico that the annual meeting is the only means of bringing all of the operating staff together so that they may become acquainted with one another.

All superintendents and department heads, their wives and such other members of the organization as can be spared from the operating units participated. Two days were devoted to meetings of the operating heads for the purpose of discussing operating problems and reading of papers of special interest on operating questions. The general policy of the company was outlined to the staff and operating plans were formed for the coming year.

Dr. Otto Sussman, vice-president of the American Metal Co., who was visiting Monterey at the time, is the only man in the accompanying photograph who is not an employee of the Penoles company.



Employees of the Cia. Minera de Peñoles, at Monterey, Mexico

Top row, left to right: E. Huerta, Remo Damm, A. Riedel, C. R. Baxter, Louis Garbrecht, G. E. Teunisson, A. G. Sauter, R. Moreno, M. Mena, V. D. Howbert, W. H. Hochschild, R. E. Overton, T. Clements, R. E. Sunde.

Middle row, left to right: L. Procissi, S. F. Shaw, A. Vizcaya, F. T. Anderson, A. B. Armstrong, E. A. Manderfeld, superintendent Santa Eulalia unit; J. M. Brooks, O. H. Withoff, M. F. Crossette, superintendent Agujita unit; A. J. Halbert, C. C. Hoke, Lic. L. de la Garze, P. B. Tartt, A. R. Fletcher, Y. Zardeneta, E. M. Gutierrez.

Bottom row, left to right: H. E. Sovereign, Y. S. Bonillas, J. N. Goddard, superintendent Torreon smelter; T. W. Wuerpel, C. J. Pinson, superintendent Ojuela unit; G. H. Harbordt, general manager; Dr. Otto Sussman, Heath Steele, president; H. Himes, treasurer; Basil Prescott, geologist; A. B. Carstens, M. W. Hayward, chief of exploration; U. H. Berthier, superintendent Monterey smelter; M. Schroeder.

A Rather Narrow Path?

Official instructions have been issued by the acting director of the Bureau of Mines to all members of its technical staff, calling attention to the necessity of exercising great care to confine work to those problems which do not encroach on the field of the professional engineer.

Utah Mining Companies Report Net Proceeds to Tax Officials

Silver King Coalition Returned $1,247,543—Reduction Important Item of Cost—Ophir Hill and Colorado Profited

The Silver King Coalition Mines Co. of Park City, Utah, reported net proceeds to the state board of equalization of Utah for taxation purposes, in conformity to law, as $1,247,543. Gross receipts were $2,991,578, and costs, $1,744,035. The cost of extraction was $921,201; reduction, $664,625; transportation, $108,964; and construction repairs to mill and reduction works, $49,243. A total of 48,848 tons of ore was produced, which yielded 2,416.392 oz. of gold, 1,757,135 oz. of silver, 27,122,854 lb. of lead, and 771,250 lb. of copper.

The Ophir Hill Consolidated Mining Co. of Tooele County, Utah, reported net proceeds of $137,722 from a gross yield of $538,058. There was produced: 352,179 oz. of silver, 5,651,826 lb. of lead, and 1,312,672 lb. of copper.

The Iron Blossom mine, at Tintic, one of the Knight properties, reports net proceeds to the amount of $87,006. The gross income was $408,378, with costs tabulated as follows: extraction, $161,090; reduction, $127,229; transportation, $33,052. There was mined 1,604 oz. of gold, 364,615 oz. of silver, 1,239,145 lb. of lead, 348,274 lb. of copper, and 11,559 lb. of bismuth. The production of bismuth in paying quantity is an interesting feature.

The Colorado, also of Tintic and a Knight property, showed gross returns of $96,782, and a cost of operation of $102,891. The Empire Mines and the Tintic drain tunnel, both controlled by the Knights, showed, respectively, a gross yield of $687.03, with costs of $1,995.32; and a gross yield of $3,407.79, with costs of $23,857.

Progress in Treatment of Complex Lead-Zinc Ores Encourages Metallurgists

Investigated by Bureau of Mines and Utah School of Mines—Preliminary Recovery of Zinc in Oxidized Ores Is Essential Step

THE RAPID DEPLETION of the world's lead supplies, with the failure to discover new orebodies, is likely to create a lead famine and to stimulate the development of the complex lead-copper-zinc sulphide ores whose treatment has long been a metallurgical problem, according to investigators for the U. S. Bureau of Mines and the State School of Mines of Utah. Much of the world's future supply of lead, it is asserted, lies tied up in these complex ores, of which the Rocky Mountain district has large reserves.

Although the hydrometallurgy of sulphide ores of zinc has been successful, and considerable amounts of zinc are now being produced electrolytically at both the Trail plant of the Consolidated Mining & Smelting Co. of Canada and the Great Falls plant of the Anaconda Co., no success commercially has been attained in treating oxidized zinc ores by similar means. There are two aspects of the problem of treating oxidized zinc ores: first, technical problems relative to the solution of the difficulties arising when treating oxidized ores, which are not met with in a serious degree when treating sulphide ores, and, second, economic considerations as to the desirability and necessity of treating oxidized ores, particularly lower grade ore than can be commercially treated by ordinary reduction methods, and especially such ores as contain lead or silver values not easily recovered in retort smelting, questions as to the actual availability of oxidized zinc ores of this type, and finally the question as to what new items of cost will be involved in treatment charges provided the technical difficulties of treating oxidized ores be solved.

The investigators point out the fact that the typical zinc ores treated at the Great Falls and Trail plants contain high percentages of sulphur, and relatively small amounts of acid-consuming bases other than zinc, and low silica. This gives them decided advantages in treatment compared with oxidized ores, which usually contain little sulphur and have considerable content of acid consuming bases and soluble silica.

The basic ideas of the work performed by these investigators, with reference to the practical solution of the acid balance problem and the soluble silica problem, were two:

First, that it might be possible to roast oxidized ores after admixture of some sulphide zinc and still sulphate enough zinc to preserve an acid balance.

Second, that by control of acidity (essentially repeated leaching with more dilute acids than is ordinarily used in practice) the soluble silica might be kept down, and the solution of impurities inhibited to such an extent as to make direct leaching of the calcine of mixed ores practically possible.

The results of the investigations indicate that mixtures of oxide and sulphide ores with an oxidized content up to 70 per cent yield sufficient water-soluble zinc on roasting to compensate for the acid radical used by the impurities in leaching.

With a 5 per cent acid leach-liquor, satisfactory zinc extractions are obtained without difficulties due to gelling of the silicate solutions.

A satisfactory removal of iron and silica from the leach liquors can be made with 30 per cent of the weight of the calcine leached, yielding solutions suitable for settling and filtration. A combined zinc extraction of 85.6 per cent can be obtained by treating the precipitate from the neutral leach with 0.6 per cent acid without excessive resolution of the impurities. The purified solutions are suitable for electrolysis.

The investigators conclude that there are large amounts of oxidized ores throughout the Rocky Mountain region that can only be beneficiated in times of abnormal zinc prices, or if a new process were installed.

For reasons of acid consumption the oxides and sulphides should be handled together. The oxide deposits are superficial.

After the removal of the zinc the remaining constituents of the ore may be readily treated; in the Rocky Mountain region it is essential to recover the residual values.

Large amounts of the nation's zinc resources are going at present into smelter slags, at a high loss to either shipper or smelter, or both; co-operation between the two is necessary for the interests of both.

By extending the use of the present hydrometallurgical process for removing zinc, in connection with the present method of recovering lead, copper, and silver, it can be shown with current cost figures, that both parties may be materially benefited, and the zinc saved.

The occurrence of oxidized ores need not be feared, and their hydrometallurgical treatment involves no impractical costs. The surety of a profitable method for treating oxidized ores will encourage the prospector and mine development, as well as stopping a great waste.

Seek Lower Rate on Copper Ingots from Pittsburgh, Pa.

The Duquesne Reduction Co., engaged in the smelting of brass and copper at Pittsburgh, has filed a complaint with the Interstate Commerce Commission attacking freight rates on brass and copper ingots from East Liberty, Pa. (a station in the Pittsburgh switching district) to St. Louis, Detroit, Cleveland, New York, Buffalo, and numerous other destinations. The existing rates are held to be unreasonable and in violation of the Interstate Commerce Act. The commission is asked to prescribe reasonable rates for the future and to award reparation covering shipments already made.

Broadway Stenogs, Bathing, Shut Down Arizona Mine

Special Correspondence from the Front

Not long ago a certain mining company, forestalling an injunction obtained by the Attorney General of New York State, moved its office, bag and baggage, from New York to the more salubrious climate of Cochise County, Ariz., where the mine is situated. Among the impedimenta was included twenty-eight stenographers — few of whom had ever been west of Hoboken, N. J. The cowboys of a near-by town, much taken by the Broadway looks and manners, promoted a dance and invited the ladies. They accepted.

Now, one of the problems at this property is a scarcity of water. Only about 20 g.p.m. are available, but the New York stenographers knew nothing about a water scarcity. The girls all took a bath and went to the dance. Had a swell time too, they say. But the mine had to shut down until the tanks were replenished.

It is understood that there is an opening here for some efficiency engineer that can figure out a plan to provide baths for the stenographers and supply enough water to keep the mine going at the same time. This problem is most serious on Saturday nights.

Some have been so unkind as to intimate that at this particular property it is more important to keep the stenographers in good operating condition than the mine.

Silver Dyke Costs Only $2.75 Per Ton of Ore

The Silver Dyke Mining Co., operating in the Neihart district in Montana, and controlled by the American Z. L. & S. Co., is milling more than 500 tons of ore a day. Above the working tunnel, which strikes the dike at a depth of 200 ft., there is one block of ore which has been opened for a length of about 400 ft. This ore carries from $6 to $50 a ton. The mining is being done by the open-pit method, with a cost of mining of about 32c. a ton. Forty tons of concentrates go to the smelter every day. The entire cost for mining, milling, and smelting is said to be less than $2.75 per ton.

Ajax Ore Shoot 16 Ft. Wide in Two Drifts

Following the discovery of the remarkable orebody in the Ajax, near Burke, in the Coeur d'Alene district in Idaho, drifting both east and west has been taken up to prove the continuity of the ore. The body is fully 16 ft. wide and is estimated to average between 15 and 20 per cent lead, with a silver content usual in Coeur d'Alene ores. Geo. A. Sprague and H. W. Woodward, of Lynn, Mass., directors of the Ajax Mining Co., arrived soon after the strike was made and remained at the mine for about two weeks. During that time meetings of the directors were held and plans for placing the property on a productive basis were developed. The Ajax joins the Hercules on the east and presumably has the same vein.

London Letter

By W. A. Doman
Special Correspondent

Speculative Issues Hold Interest in London Share Market

South African and Tin Stocks in Favor —Rubber Companies Look for Tin in Malay

London, Feb. 14—The political situation dominates the stock markets at the present moment, and there is a swing-over of interest from the gilt-edged departments to those of a speculative character. Mining shares naturally come in for attention, and honors are divided between South African descriptions and tin companies. The latter metal has risen to £281 per ton, and it is reported that America is buying heavily. The Tavoy Mining Co. (F. M. S.), whose shares were recently offered to the public, is doing well and the rate of monthly profit last announced exceeds the estimate mentioned in the document doing duty as a prospectus. As anything from £200 to £240 per ton enables the majority of producers to earn substantial profits, the market is naturally cock-a-hoop at the margin. Rumor has it that there is likely to be a shortage of the metal, and that a price of £300 will be reached. Even rubber companies do not despise the possibilities of discovering tin. The Sungei Way (Selangor) Rubber Co. states that bores sunk on its property have given favorable results, and a firm to whom a prospecting concession had been granted has exercised its option and intends to take up 500 acres for dredge mining. In the event of interference with rubber-planted ground, payment of £100 per acre has to be made.

Copper Shares Look Up

A better position is also developing here for copper mining shares, as the market for the metal is improving. It may be for speculative purposes, but the rumor is certainly prevalent that "America is buying." As I have mentioned previously, Rio Tinto have been given a boost. Other companies are now being taken in hand, and Tanganyika Concessions is being delicately handled. It is said that this company, which finances the Benguella Railway project from Lobito Bay to the Belgian Congo, is just about to conclude arrangements for the capital necessary to construct a further section of the line. The completion of the railway and the linking up with the Belgian Congo line will have an important effect upon the copper output of the Union Minière.

Bailey and Urquhart in South Africa

With Abe Bailey, H. G. Latilla and Leslie Urquhart in South Africa, it is not surprising that Rhodesian gold mines are coming into prominence. The three upon which attention is focussed at the moment are Eileen Alannah, Cam and Motor, and Sherwood Starr. It is understood that the representative of the Anglo-American Corporation is examining the first named property. It adjoins the Cam and Motor, and the opinion expressed is that the rich shoots of the latter will be found to traverse the Eileen Alannah.

At present the Sherwood Starr is opening up two levels only. On both of these, however, very satisfactory values have been disclosed. In the shallow workings a raise shows values of 103.6 dwt. over 42 in. for 57 ft. out of a total of 59 ft. At the level in another direction 21 ft. sampled averaged 31.5 dwt. over a width of 21 ft. The depth here is 80 ft. At 100 ft. lower some excellent values have been obtained, but the reef does not appear to be so wide.

Washington News

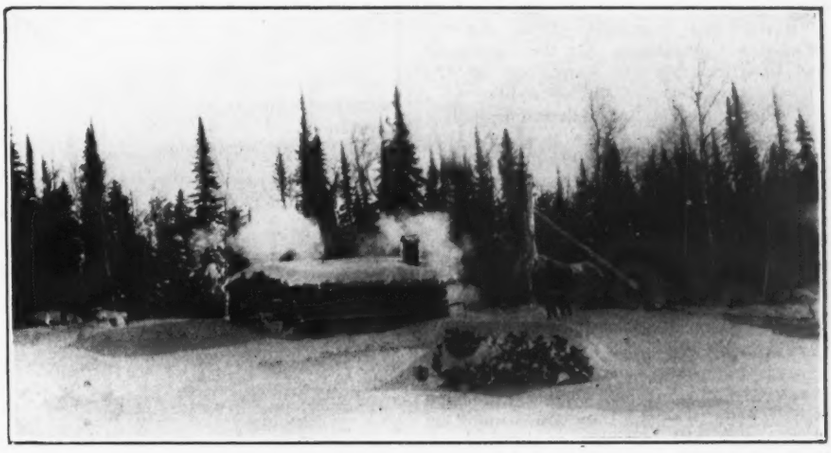
By Paul Wooton
Special Correspondent

T. L. Oddie Drafts Bill to Provide Additional W. M. R. Funds

Committee Thinks $2,000,000 Should Cover Additional Awards—Authorization by Congress Necessary

Senator Oddie, chairman of the Committee on Mines and Mining of the upper house, has prepared a bill to authorize such additional payments under the War Minerals Act as may be necessary to satisfy the claims which have been approved and certified or which may be approved and certified for payment in the future by the Secretary of the Interior. This action follows the statement of Secretary Work to the effect that the remainder of the $8,500,000 originally appropriated apparently will be inadequate to meet the claims which come within the law, as it has been amended and as it has been interpreted by the courts. It is anticipated that an additional $2,000,000 will cover all possible awards even if the Supreme Court upholds the lower courts in finding expenditures for property purchases and interest payments are reimbursible under the act. It is possible, however, that the Appropriations Committees may approve of an additional $3,000,000 so as to obviate any need for a request for an additional appropriation. In that connection, it is pointed out it is not of great moment to reduce the amount appropriated to the exact dollar of any estimate which may be made, since the money will be made available with the stipulation that only such part of it is to be expended as may be required to make payments on pending claims in the same manner payments have been made on the claims which have been settled.

Before the Appropriations Committees can act in this matter, it will be necessary for the Committee on Mines and Mining to bring out bills of authorization which must be passed before any appropriation can be made. Hence, Senator Oddie's prompt action.



Blacksmith shop and headframe of the Nipissing Mining Co. on its Powell claim in Rouyn Township, Que.

Hollinger and Nipissing Prospect in Rouyn Township, Que.

Interests connected with the Hollinger Consolidated have decided to proceed with the development of the McCraig-Bagshaw group of claims, in Rouyn Township, in northwestern Quebec. Exploration will determine whether or not the orebody on which the Noranda Mines Co. is working continues to the south. The project is said to involve $300,000. The Nipissing Mining Co. is working on the Powell claim, where the shaft has reached the depth of 30 ft. A compressor and machine drills are being shipped to the property. Cyril Knight and W. Lee Heidenreich are engaged in this work. Prospecting on a good scale is now in progress on various other claims, including the Horne, Rouyn Gold Mines, Lake Fortune, Arnsfield, and Stabell.

Diamond-drill outfits are being sent in to the Noranda and the Rouyn gold mines, and it is expected that the Dome will also send in a diamond drill in the near future. It is understood that if conditions continue as favorable as present indications promise, electric power may be brought into the mines. The Northern Canada Power Co., which is developing the Quinze power in Quebec, could run a transmission line to the district without much trouble. It is understood that this matter was the subject of negotiations between the Quebec Government and the Northern Canada Power Co. when the lease on the Quinze development was granted, about a year ago.

Committee Wonders When Alaskan Railroad Expense Will End

Discovery of One Big Mining District Would Put Road on Paying Basis—$56,000,000 Spent to Date

The first deficiency bill carries an appropriation of $865,000 for "replacements and betterments of roadways and structures and for providing additional equipment" for the Alaska Railroad. The bill also carries $245,000 for the maintenance and operation of the railroad, in addition to the amounts which may accrue from the earnings of the line.

The continued need for appropriations for the Alaska Railroad does not set well with the members of the Appropriations Committee. In the course of the hearings on the item, one of the members of the committee said:

"When the Alaska Railroad was first planned the statement was made that it would cost $35,000,000, and it was then provided that it should be constructed at that cost. Later on, the authorization was increased to $52,000,000, and then increased to $56,000,000. Every dollar of that has been appropriated, and here we have a program for an additional amount to complete the railroad. The outlook is not very encouraging for the final completion of this railroad, because, as I understand from what has been said here with reference to the conditions up there, when this program is carried out there will be another program of expenditure to meet these conditions, which, of course, nobody can control."

In reply to this, James G. Steese, the chairman of the Alaska Railroad, stated that the only eventual solution is to bring the revenues up to a point where they will carry the expenses. He admitted, however, that it would require some years before that would be possible. The building up of traffic always is slow unless some unusual development takes place.

In that connection, however, it was pointed out that the development of one mining property made possible the Copper River and Northwestern Railroad, a line 190 miles long. The opinion was expressed that the construction of that railroad cost no less than $20,000,000 and that it cost $1,000,000 a year to maintain. This instance was cited to show the possibilities of the government line, which would be put on a paying basis promptly were any one of the several mining districts which it serves to enter upon a period of rapid development.

Lower Freight Rates on Slab Zinc

As a result of a complaint filed by the Trenton Smelting & Refining Co., a freight rate on slab zinc of 13.5c. from Trenton to Baltimore has been established by the Pennsylvania and the Baltimore and Ohio railroads. The Interstate Commerce Commission examiner who is handling this complaint recommends that the commission find any rate in excess of 17c. per 100 lb. on slab zinc from Trenton to New England destinations to be unreasonable. The carriers have agreed to establish such a rate.

Granby's 1,500-Ton Concentrator Ready To Start

THE Granby Consolidated Mining, Smelting & Power Co. has completed its new 1,500-ton concentrator, and will put it in operation early in March. Though possibly not immediately, eventually, it is understood, this will cause the closing of one of the blast furnaces. The results at Anyox will be watched with considerable interest, as they will be a test, run on exactly the same conditions, of the merits of concentration against direct semi-pyritic smelting. There will necessarily have to be some experimenting at the start, especially in deciding the best method of agglomerating the flotation concentrate for reduction in the blast furnace.

During the month of January the Granby company treated 87,509 tons of ore, which, with the exception of May, 1921, when 88,075 tons was treated, is the largest tonnage that the company has handled in a month.

Arsenic Mines at Madera, Colorado, Will Be Opened

The Arsenic Products & Refining Co., a subsidiary of the Chipman Chemical Engineering Co. of New York, one of the largest users of arsenic in the world, is pushing development of the White Iron mine, at Madera, Gunnison County, Colo., and it is expected that the first shipment of ore from the property will be made about March 15. The ore will go direct to the new arsenic plant which has been constructed at Martinez, Calif. The ore from the White Iron is a high-grade mispickel. The deposit is said to be quite extensive.

Other companies are negotiating for properties. Formerly these ores were shipped in a small way to the Globe arsenic plant of the American Smelting & Refining Co. at Denver. The Globe plant refines all the arsenic produced as a byproduct of the various smelting plants of this company, and is probably one of the largest producers of arsenic in the world.

South Hecla Ships Good Ore from New Shoot

The South Hecla Mining Co. of Alta, Utah, has shipped seventeen cars of ore from its new find in hitherto unprospected ground to the west of former orebodies. The ore was opened 140 ft. above the Dwyer tunnel level, 2,700 ft. from the portal. It has been drifted on for 240 ft. on the level of discovery, and it is estimated that with 90 ft. of crosscutting, the downward extension of the ore will be reached on the tunnel level. The ore, which is carbonate, has brought $800 to $1,200 per 40-ton car after payment of freight, sampling, smelting, marketing charges. The present working force at the mine numbers thirty-two men. The condition of the wagon road down the canyon is bad and hinders hauling.

Leadville Operations Stimulated by Better Lead Market

Conditions in Leadville, Colo., seem to show considerable improvement. The increased price for lead has resulted in the movement of considerable quantities of ore that heretofore could not be profitably shipped.

Shipments of bullion from the smelting plant of the American Smelting & Refining Co. to seaboard refining points have been suspended until the latter part of March, when a much lower rate will go into effect. The Durango rate will be $13.50 and the Leadville rate $12.50, as against the present rate from both points of $16.50.

Manganese shipments from the Leadville district average about 100 tons daily, the product going to the Colorado Fuel & Iron plant at Pueblo, and the Birmingham Coal & Iron plant at Birmingham, Ala.

No Wage Increase for Montana Mine and Smelter Workers

The demand of the smeltermen, engineers, and pumpmen at Anaconda and Butte, Mont., for a wage-increase of $1 a day has been denied by the mining companies after conferences between committees from the unions and the mine operators. At present the mill and smeltermen of Anaconda are receiving $4.25 a day; first motion engineers, $6 a day; geared hoists, $5.50 a day; firemen, $5, and oilers, $4.75. Although the representatives are to report back to their respective unions the result of the conference, it is not expected that the question of the increase will be pushed any further now. The miners at present are receiving $4.75 a day, and with the present condition of the copper market any wage increase is out of the question.

Fravel Paymaster Suspends; Too Much Water for Pumps

The Fravel Paymaster Co. has been unable to handle the heavy flow of water in its mine at Peavine, north of Reno, Nev., and operations have been suspended until larger pumps can be obtained. This company has taken a working option in a group of claims belonging to the Rochester Gold Mines Co., in Lower Rochester, which cover the extensions of the small rich veins being worked by the Great Western Mining Co., and plans to start development work at once. Principal values are in gold, although there are numerous cross-fissures in which silver predominates.

Good Ore From American Star Mine, at Tintic, Utah

At the American Star mine of the Bingham Mines Co., which lies northeast of the company's Eagle & Blue Bell property at Eureka, Utah, and adjoins the Chief Consolidated, development recently begun is proving satisfactory. Already considerable ore has been shipped. Recently some exceptionally high-grade ore has been opened. Work is being done through Eagle & Blue Bell shaft on 1,700 level.

MEN YOU SHOULD KNOW ABOUT

Louis D. Huntoon has gone to Arizona for mine examination work.

J. Mackintosh Bell has sailed for England in the interests of the Vipond Consolidated company.

H. A. Thorne, superintendent of mines for the Chino Copper Co., is in Chicago for a short visit.

J. B. Haffner has been made general superintendent of the Granby company's Outsider mine, at Maple Bay, Portland Canal.

Edward H. Robie, of the *Journal-Press* editorial staff, is in Toronto attending the meeting of the Canadian Institute.

R. H. Channing, president of the United Comstock Mines Co., has been at Comstock, Nev., inspecting company operations.

J. E. Spurr gave a series of lectures on ore magmas, at the University of Wisconsin, at Madison, Wis., on March 5, 6, and 7.

Nelson Dickerman has left New York for Spokane, after which he expects to go to San Francisco, to remain some time before returning to New York.

Jules Labarthe has returned to San Francisco from Superior, Ariz., where he has been inspecting the new smelter of the Magma Copper Co. designed by his firm.

J. F. Welborn, of the Colorado Fuel & Iron Co., and **C. A. Stokes,** of Denver, with **D. W. Reckhart,** of El Paso, are inspecting properties in the Lordsburg, N. M., district.

Charles F. Rand, W. L. Saunders, and **W. H. Hardinge** will represent the A.I.M.E. at the Empire Mining and Metallurgical Congress in London in June of this year.

James J. Godfrey, president of the Mother Lode Copper Mines Co. of Alaska, who has been visiting Arizona copper camps and Los Angeles, has returned to New York.

Djevad Eyoub is making geological examinations near Tampico. He writes "I will be glad to give you an account of the life of a geologist in the midst of revolution when I get back."

C. E. Chaffin, manager of the New York office of the General Engineering Co., of Salt Lake City, Utah, who has been spending some time in the Southwest, has returned to the East.

Livingston Wernecke, geologist for the Alaska Treadwell Gold Mining Co., and in charge of the operations of the Yukon Treadwell property in the Mayo district, Y. T., left San Francisco recently for Alaska.

Charles Henry White, consulting geologist of San Francisco, has been in New York since the Institute meeting and expects to visit various other Eastern points before his return.

John W. Mulholland, well-known Kootenay prospector and founder and president of the British Columbia Prospectors' Protective Association, has gone to Hollywood, Calif., where he purposes to take up scenario writing.

R. L. Chase, of Denver, will be in Los Angeles during the month of March. The month of April will be spent examining mines in the State of Sinaloa, Mexico, and the month of May in Chihuahua, Mexico. Mr. Chase will return to Denver about June 1.

Donald G. Miller, formerly a Phelps Dodge Corporation official at Tyrone, N. M., went into the Balsas country, in Michoacan, Mexico, before the outbreak, and has not been heard of for some time. According to press reports of Feb. 23, Mr. Miller was safe and accompanying General Silvestre Castro's army en route to the City of Mexico.

C. H. Munro

C. H. Munro, recently resident manager of the Yukon Gold Co.'s tin-dredging properties in the Malay States, has, with **Robert Marsh,** formerly with the Guggenheims, opened offices for consulting engineering work in the Hobart Building, San Francisco.

Walter Douglas, president of the Phelps Dodge Corporation, has been spending several weeks inspecting the Southwest holdings of the corporation. He is accompanied by **Arthur Curtis James,** a director; **P. G. Beckett,** general manager; **W. C. Osborn,** director; **Gerald Sherman,** consulting engineer of the mining department, and **Charles Le Grande,** consulting engineer of the mechanical department — all of the Phelps Dodge organization.

Mark R. Lamb, consulting engineer for the Corporación Minera de Famatina, in Argentina, and **H. A. Barker,** resident manager, have just returned from an examination of the coal beds near Marayes, in San Juan. This coal is of low grade, high ash, and very friable. Large-scale tests have shown that it is suitable for the coal-dust fired reverberatory at Santa Florentina. Tests also show that the coal can be crushed and washed so as to materially reduce the ash and permit the manufacture of coke suitable for copper water-jacketed furnaces, as the use of this coal in place of the imported fuel will reduce the fuel cost 50 per cent.

OBITUARY

John D. Matheson

John Duncan Matheson, general superintendent for the Walter Fitch, Jr., Contracting Co., of Eureka, Utah, for the last ten years, and in charge of operations for the company in Utah, Pennsylvania, California, Nevada, and other states, died on the evening of Feb. 25 at a hospital in Salt Lake City, Utah, after a long illness. Mr. Matheson, who was forty-nine years old at the time of his death, was known as one of the best drill men in the country. He was in charge of operations when the Walter Fitch, Jr., company made the world's record two years ago in sinking the Water Lily shaft of the Chief Consolidated at Eureka, Utah, and received the medal awarded by the *Engineering and Mining Journal-Press.* Mr. Matheson was born in Nova Scotia, coming to Utah in 1913. He is survived by a widow and one son.

An Appreciation by Burt B. Brewster

Poudre, Homansville, Water Lily and deep hole drilling. To most followers of mining, these names mean only achievement and world's records. To those of us who were privileged to know him, these mile posts in hard-rock history mean John Matheson.

Matheson did not know the meaning of "quit." Every shift was his shift as long as there was some round to finish or some muck to move, and it was this characteristic which undoubtedly shortened his life by many years.

Unquestionably one of the best judges of drilling machines, of how to handle rock, and how to organize a crew, John Matheson will be missed for more than sentimental reasons.

Philip John Mackintosh, general manager of the Three Kings Mining Co., at Park City, Utah, lost his life on Feb. 25 in a somewhat peculiar accident, while making a visit of inspection to the property in the company of Forest Mathez, consulting engineer for the company. As the two men were proceeding along one of the levels of the mine, Mr. Mackintosh was struck on the head and instantly killed by a boulder of slate or limestone. Mr. Mackintosh was thirty-eight years old, and leaves a wife and daughter.

William Nicol, for twenty-five years professor of mineralogy at Queens University, Kingston, Ont., died on Feb. 24 after a protracted illness. He was sixty-three years old. Nicol Hall, one of the university buildings devoted to the teaching of mineralogy and metallurgy, owes its inception to a large donation by Professor Nicol. He is survived by his widow.

George Howald, superintendent of the Mineral Mining & Milling Corporation, operating lepidolite mines 14 miles from Embudo, Taos County, N. M., was killed instantly when the powder house blew up Feb. 19. He was twenty-eight years old and was a native of Georgia.

Societies, Addresses, and Reports

Seeks to Improve Mining in Colorado Districts

Committee of Mining Association Wants Facts as to Ore Not Marketable Under Present Conditions

To inquire into conditions which now prevail in many of the metal-mining districts of Colorado, for the purpose of obtaining information upon which to base recommendations for measures which will tend to rehabilitate the mining industry, particularly in the northern counties, a committee of the Colorado Metal Mining Association has been appointed by Jesse F. McDonald, the president.

The appointment was in conformance with a resolution adopted at the joint annual meeting of the Colorado mining organization, and was recommended by the Governor of Colorado and by the Mining Bureau of the Denver Civic and Commercial Association. Appointees are Horace F. Lunt, former Commissioner of Mines; C. N. Bell, Liberty Bell Mining & Milling Co.; Senator W. E. Renshaw, manager of the Gem Mines Co.; Robert H. Sayre, trustee of the Colorado School of Mines, and R. J. Walter, mining engineer.

The committee met for organization on Feb. 20, and selected H. F. Lunt as chairman and M. B. Tomblin as secretary. As a preliminary step, it sent out a letter to the mine owners of the state announcing the appointment of the committee and its purpose, and stating that the committee wished to obtain information regarding ore which at present is not being marketed, but which could be produced under favorable conditions, or ore that is being marketed disadvantageously. Data were asked for concerning ore of any specific grade or character which could be shipped daily at this time, and how much the shipment could be increased within a few months providing a market was created.

Particular consideration is to be given to the situation in the counties of Boulder, Gilpin, and Clear Creek, where conditions have been aggravated by the closing down of the Denver and Pueblo smelters, necessitating a long and costly haul to the Leadville plant of the American Smelting & Refining Co.

Trade Terms of Foreign Commerce Interpreted

The recognized interpretation of trade terms and abbreviations as in use in the larger commercial countries is contained in a booklet recently issued by the International Chamber of Commerce, at Paris. Copies of the publication, which is in both English and French, are being distributed among the American members of the International Chamber. Non-members in the United States may obtain copies through the secretary of the American Section of the organization, at Washington. The American Section says:

"Publication of the digest marks the first serious effort on the part of business interests throughout the world to bring some order out of the chaos in the interpretation of trade terms.

"The use of the cable in the quotation of prices, as well as the use of the brief business letter, has led to the omission of elaborate details in contractual obligations and to the use, in their stead, of trade terms, in particular the terms "F. O. B.," "F. A. S." and "C. I. F." Each nation has witnessed the growth of its own particular set of definitions and has for the large part left it to the individual trader to discover—often to his sorrow—the points of difference between definitions of his and other commercial nations.

"For instance, American business men had been lectured frequently by their overseas clients upon the exact meaning of "F. O. B." The American interpretation of "F. O. B." corresponded to the British expression "F. O. R." (free on rail), or "F. O. T." (free on truck). The Britisher also used the term "F. O. B.," but had in mind the obligations assumed by the American quotation "F. O. B. vessel," and this seemingly small conflict in meaning between the American and British interpretation was the cause of many bitter disputes in overseas trade.

"Aware of the difficulties that would be encountered in any endeavor to bring about uniformity in the interpretation of trade terms, the Committee of the International Chamber of Commerce which prepared the digest took as their objective the publishing of a clear statement of the recognized interpretation of terms and abbreviations.

"The American definitions were carefully surveyed by a committee consisting of C. D. Young, resident attorney of the American Trading Co.; C. D. Snow, manager of the Foreign Commerce Department, Chamber of Commerce of the United States, and E. A. LeRoy, Jr., National Foreign Trade Council."

Research Fellowships Offered at Seattle

The College of Mines of the University of Washington is offering five fellowships for research in mining, metallurgy, and ceramics in co-operative work with the Bureau of Mines. These are open to properly qualified graduates of universities and technical schools. The value of each is $810 per year of twelve months, beginning July 1. Fellowship holders pay the usual tuition and partial laboratory fees; they register as graduate students and became candidates for the degree of master of science.

The purpose of these fellowships is to undertake the solution of various problems being studied by the U. S. Bureau of Mines that are of especial importance to the State of Washington, the Pacific Northwest, and Alaska.

Louisville Picked for Meeting of National Safety Council

The National Safety Council will hold its thirteenth Annual Safety Congress in Louisville, Ky., Sept. 29 to Oct. 3, according to an announcement by W. H. Cameron, managing director, following a meeting of the executive committee in Chicago recently.

The Engineering Section will join with the Cleveland Safety Council, the Society of Ohio Safety Engineers, and the Cleveland Engineering Society May 16 in a comprehensive safety conference in Cleveland. The general topics to be discussed by prominent safety men are "Safety Legislation and Codes" and "Plant Housekeeping."

Four hundred safety engineers, foremen, superintendents, and industrial physicians attended the mid-year safety conference of the Engineering Section, the Chicago Safety Council and the Western Society of Engineers that was held in Chicago Feb. 19. These safety boosters represented the Chicago district, including Illinois, Wisconsin, and Michigan.

C. H. Wagemann Elected Chairman of Colorado Section, A.I.M.E.

The Colorado section of the American Institute of Mining and Metallurgical Engineers held its annual banquet and election at the Albany Hotel in Denver on Feb. 29. M. E. Campbell, supervisor of oil and leasing operations of the U. S. Bureau of Mines, was the principal speaker. He spoke on the subject "Government Methods for Maximum Recovery of Oil and Gas."

Carrol H. Wagemann, of the Midwest Oil Co., was elected chairman of the section; Howard H. Field, of the American Smelting & Refining Co., vice-chairman, and Charles M. Henderson, of the U. S. Geological Survey, secretary-treasurer. Robert H. Sayre and J. Claire Evans were elected directors for the two-year term.

Standardization Bulletin Out

The fourth national standardization bulletin of the American Mining Congress is now ready for distribution. This bulletin carries comprehensive reports on standardization of mining methods, practice, and equipment as applied to mine timbering (coal and metal); mine drainage (coal); mine ventilation (metal); underground transportation (coal); mechanical loading underground (metal); fire-fighting equipment (metal); drill steel (metal), and mining and loading equipment (coal).

Award Medal to Australian Metallurgists

The gold medal of the Institution of Mining and Metallurgy (the premier distinction within the gift of the Institution) has been awarded conjointly to Herbert William Gepp and Gilbert Rigg, in recognition of their joint and individual services in the advancement of metallurgical science and practice, with special reference to their achievements in the treatment of complex sulphide ores and in the development of the electrolytic process for the production of zinc in Australia.

New Machinery and Inventions

New Air Drill Developed for Reaming Service

A One-Man Machine That Readily Handles a Constantly Changing Load, It Is Claimed

A portable air drill for reaming service and with the ability to handle a constantly fluctuating load has been developed by the Chicago Pneumatic Tool Co., of New York. Though the design of this, the No. 36 Red Giant air drill, is not revolutionary, it is nevertheless unique, and, according to the manufacturer, possesses all the points of advantage incident to stability, reliability, low maintenance, ease of operation, and adaptability for reaming or drilling purposes. These claims are based on extensive trials conducted in the plants of many large users of pneumatic equipment.

The weight of the drill is 35 lb. The drill is thus light enough to be classed as strictly a one-man machine for down- or side-hole reaming. The balance is perfect so that the drill is easy to handle or control. The spindle is of the extension type, with tang slot for convenient ejection of reamer or drill facilitating this operation when a change becomes necessary. As to power, the drill exceeds that of any other type or make of air drill that is plain spur-geared and of similar weight.

The connecting rods are attached to the crosshead by means of a standard-design wrist pin, as in steam-engine practice, obviating the use of connecting rod toggle. Cylinders are of the double-acting type and are provided with packing gland (or stuffing box) which prevents the leakage of air into the crank case. Pistons are of the double-acting type turned from special low-carbon steel bars and accurately ground to size. They are each provided with two packing rings. The crosshead and guide prevent side thrust against the pistons and reduce cylinder wear to a minimum. The eccentrics are forged integral with the crank shaft, being located between the crank pins (or throws). They are of liberal dimensions and accurately balanced.

Valves are of the balance piston type, long-wearing and leak-proof. They have no pressure holding them to their seats and require no appreciable power for their operation. The valves are so located as to give the greatest economy in the use of air.

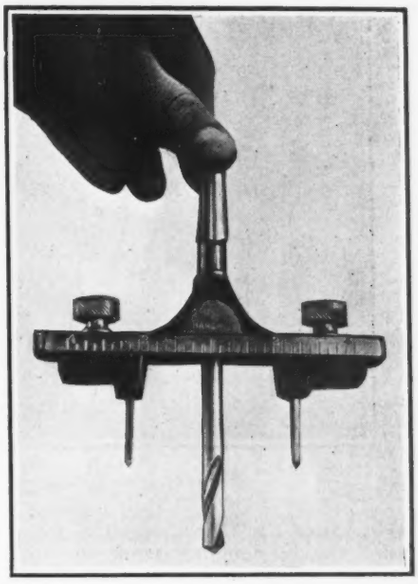
The crank shaft is forged from high-grade nickel steel, heat-treated to give high tensile strength in the throws and hardness at the wearing points. It differs slightly from the standard Little Giant design, having the eccentrics between the throws and an integral part of the forging. The crank shaft is mounted on three ball bearings. The extra bearing insures proper shaft support on both sides of the main drive gear and adds materially to the frictionless qualities desired for maximum power and efficiency.

Crank pinion and ball gear are of the stub-tooth type, perfected by and so extensively used by the automotive industry. These gears have teeth thicker at the roots and shorter in length than the standard involute gears; they are stronger and more compact, almost totally eliminating pinion or gear failures under the severest service possible. All working parts have a large factor of safety.

The lubrication is economical. The motor being double acting and provided with packing gland (or stuffing box), there is no leakage of air into the crank case. Splash lubrication is used, and, as there is no air to bleed from the crank chamber, there is no loss of lubricant via the escaping air.

Device Cuts Circular Holes in Sheet Metal

A convenient tool is being manufactured for use in cutting circular holes in sheet metal, wood, or fibre and should be of use in a mine machine shop. Knurled thumb screws adjust the steel cutting blades so that circles from 1 to 4 in. in diameter may be procured. A center drill is used to drill a lead hole in the material to be cut, so that the circle-cutting blades will have opportunity to start a true circle. This cutter is manufactured by the Cincinnati Tool Co., Norwood, Cincinnati, Ohio.

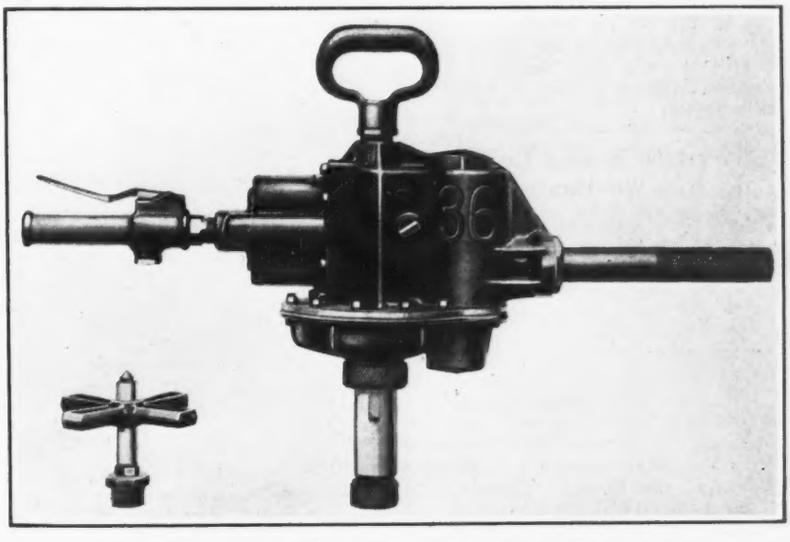


This device will cut holes 1 to 4 in. in diameter in metal

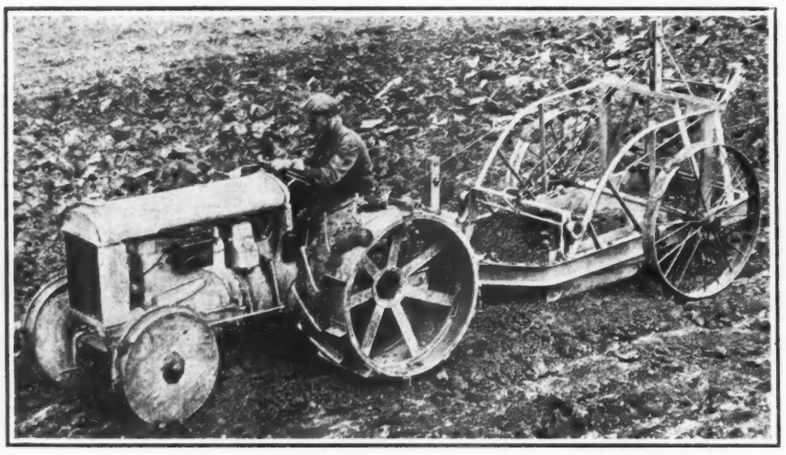
Power Scraper for Stripping and Other Purposes

A one-man power scraper has been designed by the Miami Trailer Co. of Troy, Ohio, for use exclusively with the Fordson tractor. The power winch is constructed so that it bolts onto the rear axle housing with four stud bolts and clamps on the rear axle of the tractor by means of a U-bolt. This winch is made of cast steel with a worm and gear to operate the revolving drum. The gearing is driven by a friction clutch, and power is taken from the belt pulley arm on the tractor to the revolving drum on the winch. To the drum is attached the ⅜-in. cable which elevates the scoop to any desired position.

When loading, the bottom of the pan is almost parallel with the ground and remains in the same relative position until fully loaded. This reduces the drawbar pull of the scraper about 50 per cent below that of any other machine. It also permits the scoop to fill to capacity every trip. The operator drives forward, at the same time holding the control lever at his right. The pan is instantly lowered to the desired depth. As soon as the pan is completely filled, the operator pushes forward on the control lever, thereby engaging the friction clutch. This causes the winch to operate, and, by means of the cable, elevates the front of the pan to about a 15-deg. angle. The bottom of the pan at the rear is then about 9-in. from



Air drill for reaming under constantly changing load



Tractor and scraper form compact one-man unit

the ground. In this position the driver runs to the dumping point in either second or high speed at a rate of from 2 to 6 miles per hour. The pan is so designed that the dirt cannot roll off either at the front or rear.

The scraper is intended for moving dirt or sand in road construction; for city subdivision work; for stripping coal or other mineral veins or for gravel pits; for excavation; or for building embankments.

As soon as the unit reaches the dump, the operator again pushes forward on the control lever and again winds the pan up to a perpendicular position. This allows all of the dirt to roll out at the rear. The material will dump all in one spot if the tractor is stopped for an instant, but will distribute it over the ground if kept in motion. The operator then returns to the loading point.

The scraper is built entirely of steel and is well reinforced at every vital point. It is so constructed that it can be disconnected from the tractor in about three minutes. This leaves the tractor free to use for plowing, grading, or trailer hauling. The power winch does not interfere with the regular hitch and may be left on the tractor permanently, as it does not operate except when the friction clutch is engaged by the control lever.

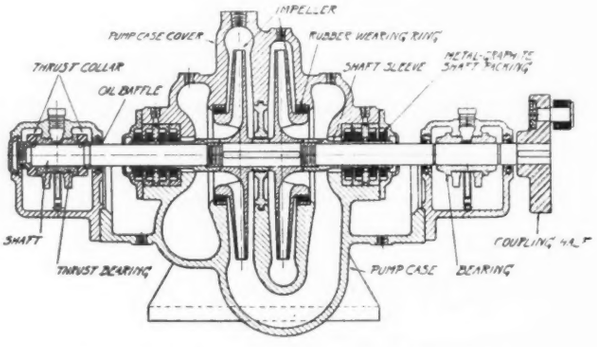
The company claims that this scraper unit will replace four teams and six men, thus making a reduction in unit costs possible.

Oliver Iron Mining Co. Has New Air-Dump Car

A new air-dump car has been developed for the Oliver Iron Mining Co. by the Western Wheeled Scraper Co., Aurora, Ill. This car has seventy tons' capacity and holds 30 cu.yd. level full. The car weighs about forty-one tons. In most respects it is like the company's standard 30-cu.yd. car, but the essential parts have been strengthened. This is particularly true of the bed-frame, on account of the service, which is very heavy. The Oliver company is loading with 8-cu.yd. and 10-cu.yd. shovels. The new car is designed for stripping and for handling low-grade ore from the shovels.

This Centrifugal Pump Has Two Features

The new centrifugal pump made by the Moore Steam Turbine Corporation, Wellsville, N. Y., overcomes two trouble-some features with which the operating engineer especially has to contend. These difficulties are obviated by the use of an improved rubber sealing ring on the impeller between the suction and discharge chambers, and the use of a metal graphite packing ring in the packing glands, instead of the ordinary flax packing.



Sectional view of new centrifugal pump

The average user of a centrifugal pump is usually in search of high efficiency. The shop test on a pump is run under ideal conditions—with the packing gland nuts loosened—so that the flax packing in the stuffing box will not create a "drag" on the shaft. After the pump is placed in operation, any workman in the plant may pack the stuffing box as tight as possible and squeeze the packing together until there is no leakage. This exerts a powerful pressure between the flax packing and the shaft and consequently lowers the efficiency of the pump. Sufficient tightening of the packing will often "stall" the prime mover.

The metal graphite packing rings in the Moore pump rest lightly upon the revolving shaft. There is no binding effect to retard rotation. The new metal graphite packing ring is in no way effected by hot or cold water, and, once it is properly fitted, leakage is reduced to a minimum. The life of this packing is practically unlimited when the shaft runs without eccentricity, and the shop-test efficiency of the pump will always be maintained in service. The efficiency cannot vary or be dependent upon the whims of a plant workman.

These pumps are horizontally split, perfectly balanced, use brass protected chrome-nickel steel shafts, and are built to limit gages in a shop equipped for and accustomed to precision work. They are built single and multistage, for motor, turbine, or belt drive.

An effort has been made in designing this pump to embody all points of excellence heretofore found in successful pumps.

Distant Dial for Watthour Meters

The General Electric Co. has developed a distant dial mechanism for use with watthour meters where, for various reasons, it is desired to have the registration of the meter appear at a point remote from that where it is installed. This device is actuated through a contact mechanism in the register of the watthour meter.

Air-dump car of 30 cu.yd. or seventy tons' capacity. It weighs forty-one tons

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
28	13.00@13.125	54.25	54.75	9.20	9.15	6.75@6.80
29	13.125@13.375	55.25	55.75	9.20	9.15	6.75@6.775
Mc. 1	13.25@13.50	55.375	55.875	9.10	9.10	6.75@6.80
3	13.50@13.75	56.00	56.50	9.05	9.10	6.75
4	13.625@13.75	55.25	55.75	9.05	9.10	6.70
5	13.50@13.625	56.00	56.50	9.05	9.10	6.70
Av.	13.427	55.354	55.854	9.108	9.117	6.744

*These prices correspond to the following quotations for copper delivered: Feb. 28th, 13.25@13.375c.; 29th, 13.375@13.625c.; Mar. 1st, 13.50@13.75c.; 3d, 13.75@14.00; 4th, 13.875@14.00c.; 5th, 13.75@13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
28	64¼	65⅝	69½	282¼	280¼	37⅜	36⅝	37½	36⅝
29	66	67¼	70½	288¼	284½	37½	36½	37¾	36⅜
Mar. 3	67¾	68¼	73	292½	289	37¾	36¾	36¾	36⅜
4	67¼	68½	73	289¾	287½	38	36⅝	36¾	36¼
5	66⅞	67⅝	72	291½	289½	38⅜	37	36⅛	35⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
28	4.29⅜	63¾	33 3/16	96s 0d	3	4.29½	64	33 7/16	95s 11d
29	4.29⅞	64⅛	33 7/16	95s11d	4	4.29	63⅞	33⅜	96s 2d
Mar 1	4.29¾	64¼	33 9/16	.....	5	4.29⅝	64	33 7/16	95s 11d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Average Metal Prices for February

Copper:	
New York Electrolytic	12.708
London Standard	63.113
London Electrolytic	68.167
Lead:	
New York	8.554
St. Louis	8.643
London	34.589
Silver:	
New York	64.359
London	33.565
Sterling Exchange	430.457
Zinc:	
St. Louis	6.756
London	36.518
Tin:	
99 per cent	52.772
Straits	53.272
London	272.399
Quicksilver	59.565
Antimony	10.935
Platinum:	
Refined	124.739
Crude	115.935

Metal Markets

New York, March 5, 1924

The most interesting price movement during the week has been the advance in the price of copper, which has carried the metal rapidly upward. On the other hand, the zinc market has declined, owing to decreased willingness to buy on the part of consumers. Lead remains in a strong position, with only a small amount of prompt shipment metal available.

Copper

The improvement in the copper market may be accounted for by a number of reasons, the principal one being the rise in the London market, which had the effect of causing producers here to make corresponding advances. Then there has been talk of curtailment of production, a proceeding that would lead to higher prices provided the good demand for the metal does not diminish.

So far as sales are concerned, the amount of business done has been light. Purchases were well diversified among producers and at widely varying prices, owing to the rapidly changing market. Earlier in the week copper sold for 13.25c. delivered. Last Monday and Tuesday it was sold for as high as 14c. delivered. Today, however, owing to the easier tendency abroad, the metal can be had from at least two sellers for 13.75c. delivered in good-sized tonnages. The hesitancy on the part of manufacturers is due not only to a desire to see how the London market behaves, but also to observe how the recent advances in the price of finished products will be met by consumers.

Lead

On Thursday, Feb. 28, the American Smelting & Refining Co. advanced its official contract price from 8.90c. to 9c. per lb., New York.

The lead situation has not shown much change. Last Thursday and Friday large tonnages of foreign lead were sold in the New York market at 9.50c. A price of 9.625c. was also paid. Since then considerable lead has been sold in the same market at 9c. for May delivery. In fact, some sales in good volume were reported as low as 8.95c. for delivery in April and May. Although many consumers are interested in having prompt lead, the fact remains that prompt sales are only a small proportion of the total sales made. Most of the business has been for forward shipment, particularly in May. It is noticeable that the desire of manufacturers to purchase lead is not so great at present prices as it has been on the way up. At least one ammunition, one storage-battery, one paint and one electrical manufacturer have stated that the high price is causing them anxiety so far as their outlet for the metal is concerned. The St. Louis market is strong, and small lots of spot lead have been sold as high as 10c. per lb. there. On the other hand, much larger tonnages have also been sold to realize 9c. for delivery next month.

Zinc

Zinc prices have softened. The Joplin ore market has also declined. Both changes are, of course, interrelated. A

week ago Prime Western metal was sold for 6.80c. in St. Louis; today it can be had for 6.70c., and there is talk of that price being shaded. Europe is now below the American parity, so that export business is not encouraged. High-grade metal has been sold for 8¼ to 8⅜c. per lb.

Tin

Tin prices continue to climb, but there is no scramble for the metal. Consumers are content with filling only current requirements.

Foreign Exchange

The French franc continues to decline. On Tuesday, March 4, francs were 4.08c.; lire, 4.29c. and Montreal funds on New York, 3¼ per cent discount.

Silver

The market has been steady on moderate buying for India account, although China continues quiet.

Mexican Dollars—Feb. 28, 48⅝; 29th, 48¼; March 1st, 49; 3d, 48⅞; 4th, 48¾; 5th, 48¼.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28c. per lb.; 98 per cent, 27c.

London, 98 per cent, £115 per long ton.

Antimony—Per lb.:

Chinese and Japanese brands, 11¼ @11½c.

W. C. C. brand, 13c.

Cookson's "C" grade, 14½c.

Chinese needle, lump, nominal, 8@9c.

Standard powdered needle, 200 mesh, 8¾c.@9½c.

White oxide, Chinese, 99 per cent Sb_2O_3, 9c.

Metal scarce and in good demand. Prices stronger. Conditions in China are becoming better.

Bismuth—$2.35@$2.45 per lb. London, 10s.

American price is a reflection of London price.

Cadmium—70@75c. per lb. London, 2s. 6d.

Cheap Australian metal is keeping market down.

Cobalt—$2.50@$3 per lb. Discounts on contracts. Oxide, $2.10@$2.25. London, 11s. for metal; 9s. for black oxide.

Iridium—$275@$300 per oz.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, 90c. per lb. London quotes 3s. 3d. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—26@30c. per lb. for 99 per cent virgin metal. London, £130@£135.

Osmium—$100@$110 per troy oz.

Osmiridium—Crude, $58.50 per oz.

Palladium—$83 per oz. Crude, $60 per oz. London, £17.

Platinum—Refined, $125 per oz.

Crude, $113@$115.

London, £28 for manufactured.

Refined price can be shaded, depending upon terms of sale. Spread between crude and refined prices unusually large. Manufacturers are not very anxious buyers, so that prices of crude have softened.

Quicksilver—$59@$61 per 75-lb. flask. San Francisco wires $59.35. London, £9¾.

Market quiet with prices nominal.

Radium—$70 per mg. radium content.

Rhodium—$100@$105 per oz.

Solenium—Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tantalum—Metal, $400 per kg.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 95c.@$1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:

Indian, $19.50.

Rhodesian, $21.50.

New Caledonian, $24.

Not very much activity.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports:

Old Range, bessemer, 55 per cent iron, $6.45.

Mesabi, bessemer, 55 per cent iron, $6.20.

Old Range, non-bessemer, 51½ per cent iron, $5.70.

Mesabi, non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y., per long ton:

Old bed, 21 furnace, $5.

Old bed, concentrates, 63 per cent, $5.25.

Harmony, cobbed, 63 per cent, $5.25.

New bed, low-phosphorus, 65 per cent, $7.50.

Manganese Ore—44@46c. per long ton unit, seaport, plus duty.

Molybdenum Ore—75c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates. Nominal.

Tantalum—Foreign, 55c. per lb. of Ta_2O_5 contained, c.i.f. New York. Contains about 65 per cent Ta_2O_5 and 5 per cent Cb_2O_5.

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite, $9@$9.25.

High-grade scheelite, $9.50.

Ordinary grades, $8.75.

Prices have become slightly stronger as stocks are being consumed.

Vanadium—Minimum 50 per cent V_2O_5, $1@$1.25 per lb. Nominal.

Zircon—$50 per ton.

Zinc and Lead Ore Markets

Joplin, Mo., March 1—Zinc blende, per ton, high, $47.75; basis 60 per cent zinc, premium, $46; Prime Western, $44@$43; fines and slimes, $42@$41; average settling price, all blende, $44.24. Calamine, basis 40 per cent zinc, $24.

Lead, high, $126.65; basis 80 per cent lead, $125; average settling price, all lead ore, $119.87 per ton.

Shipments for the week: Blende, 17,186; calamine, 104; lead, 2,330 tons. Value, all ores the week, $1,042,100.

Buyers were firm in offers of $43 and no higher price for Prime Western, and were under instructions to reduce purchases to a minimum point if this was not acceptable. Sellers held until late this afternoon before capitulating to the lower offerings, finally accepting this price and disposing of 15,310 tons.

Lead was firm on the basis of $125 and sales were freely made.

Platteville, Wis., March 1—Blende, basis 60 per cent zinc, $48 per ton. Lead, basis 80 per cent lead, $124 per ton. Shipments for the week: Blende, 417 tons; lead, 80 tons. Shipments for the year: Blende, 4,715; lead, 200 tons. Shipments for the week to separating plants, 676 tons blende.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide as to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

Asbestos:

Crude No. 1—$300@$400.

Crude No. 2—$175@$225.

Spinning fibers—$90@$150.

Magnesia and compressed sheet fibers —$60@$90.

Shingle stock—$50@$70.

Paper stock—$32.50@$40.

Cement stock—$20@$25.

Floats—$7@$9.

All per short ton, f.o.b. mines, Quebec, tax and bags included.

Prices low. Keen competition for business. Short fibers moving much better than long, in which Rhodesian competition is felt.

No. 1 Rhodesian crude, $325; No. 2, $200 per short ton, c.i.f. New York.

Barytes—Crude—$8 per ton, Missouri mines, 90@98 per cent $BaSO_4$; $8.50 per ton, f.o.b. Georgia mines; $6 @$8, at Baltimore.

Ground—Off color, $13 per ton, Baltimore; white, $16, Baltimore.

Water ground and floated, $23@$25, f.o.b. St. Louis.

Good demand for crude ore by the chemical trade and especially lithopone manufacturers, who are very active.

Bauxite—American, f.o.b. shipping point per gross ton:

Crushed and dried, $5.50@$8.75.

Pulverized and dried, $12@$14.

Calcined, crushed, $20.

Foreign, per metric ton c.i.f.:

French, 5 per cent SiO_2, $5@$6.50.

Dalmatian, low SiO_2, $6.50@$7.50.

Other grades, $4.65@$6.

Beryl—4½c. per lb. f.o.b. Connecticut points. Nominal.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbs., 5½c. Boric acid, 10½c.

Market about normal.

Chalk—F.o.b. New York, per lb.:

English, extra light, 5c.

Domestic, light, 4¼@4½c.

Domestic, heavy, 3½@3¾c.

In bulk, $5@$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:

Crude No. 1, $7.

Crude No. 2, $6.

Washed, $8.50.

Powdered, $13@$20.

Powdered (Blue Ridge), $14@$20.

Imported English, f.o.b. American ports:

Lump, $15@$20.

Powdered, $45@$50.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

1A grade, domestic, $16.50@$18, f.o.b. mines.
Market good for both foreign and domestic grades.

Diatomaceous Earth—Per ton, f.o.b plant, California:
Kiln-fired brick, $65.
Kiln-fired aggregate, $45.
Insulating powder, $30.
Natural aggregate, $20.

Emery—Per lb., f.o.b. plant:
Greek Naxos, 6½c.
Turkish, 6½c.
Khasia, 5½c.
American, 4c.
Demand has improved.

Feldspar—Per long ton, f.o.b. cars, North Carolina:
No. 1 pottery grade, $6.50@$7.50, depending upon quality.
No. 2 pottery grade, $4.50@$5, depending upon quality.
No. 1 soap grade, $7.
Ground, 90 to 100 mesh, $10 per short ton.
In Connecticut, per net ton, f.o.b. mines:
60 to 80 mesh, $20.
150 mesh, $25.
200 mesh, $30.
Good demand.
In New Hampshire, per net ton, f.o.b. mines:
Pottery grade, $7.
No. 1, not exceeding 10 per cent SiO_2, $8.
Ground, $17@$20, f.o.b. mill.
In New York, per ton, f.o.b. cars:
No. 1, $8.
Demand good.
In Maine:
No. 1 ground, $19.
In Tennessee:
No. 1 ground, $15.32@$21 per ton, f.o.b. mill.
Inferior grades, ground, $10 per ton.
Crude, $6.50 for ordinary grades. As high as $7.50 offered for exceptional quality.
In Canada:
No. 1 crude, $7 per short ton.
No. 1 ground, 180 mesh, $20.
Reports from producers generally indicate a good market for crude and ground material in the pottery and soap trade.

Fluorspar—F.o.b. western mines, per net ton:
Not less than 80 per cent CaF_2 and not over 5 per cent SiO_2, $22.
Not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $23.
Ground, 93 to 97 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels.
Acid ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.
Market slightly more active. Importations less than usual.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:
16 to 30 mesh, $16.50.
16 to 60 mesh, $18.
30 to 60 mesh, $18.
60 to 100 mesh, $14.
Plus 100 mesh, $7.50.

Garnet—Per short ton:
Spanish grades, $60, c.i.f. port of entry.
Domestic Adirondack, $85, f.o.b. shipping point.
Canadian, $70@$80, f.o.b. mines.

Graphite—First quality, per lb.:
Ceylon lump, 5½@6c.
Ceylon chip, 4½@5c.
Ceylon dust, 3½@4c.
Crude amorphous, $15@$35 per ton.

Gypsum—Per ton, depending upon source:
Crushed rock, $3@$4.50.
Ground, $3.50@$6.
Agricultural, $5@$7.
Calcined, $8@$16.

Ilmenite—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. Virginia points. $20 per short ton, Florida mines.

Kaolin—See China Clay.

Limestone—Depending upon source, f.o.b. shipping points; per ton:
Crushed, ½ in. and less, $1.10@$1.70.
Crushed, 3 in. and larger, 90c.@$1.50.
Agricultural, $1.50@$5.

Magnesite—Per ton, f.o.b. California mines:
Calcined lump, 85 per cent MgO, $35.
Calcined ground, 200 mesh, $42.50.
Dead burned, $32@$34, Washington.
Dead burned, $40@$42, Chester, Pa.
Caustic calcined, Grecian, $50@$51, c.i.f., New York.
Market good. California and Washington producers report active demand.

Manjak—Barbados, in 1 to 5 ton lots:
Grade "A," 8@11c. per lb.
Grade "AA," 9½@12½c. per lb.
Grade "C," fine, 10½@13½c. per lb.
Grade "C," fine and lump, 12@15c.
Grade "C," lump, 13½@16½c.

Mica—
North Carolina prices:
Scrap, $17@$20 per ton.
Sheet, per lb., No. 1 quality, clear:
Punch, 1¼ in., 6c.

1½ x 2 in., 15c.	3 x 4 in., $1.75.
2 x 2 in., 30c.	3 x 5 in., $2.
2 x 3 in., 70c.	4 x 6 in., $3.
3 x 3 in., $1.25.	6 x 8 in., $4.50.

Ground, 60 mesh, $65 per ton.
Ground, 80 mesh, $70.
Ground, 120 mesh, $120.
Ground, 140 mesh, $125.
In New Hampshire:
Washer and disk, $280 per ton.
Scrap, $24 per ton.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Ocher—"Yellow Peruvian," $20@$30 per ton, Georgia mines.

Phosphate — Per long ton, f.o.b., Florida.
76@77 per cent, pebble, $6.25.
75 per cent, $5.75.
74@75 per cent, $5.50.
70 per cent, $3.80.
68 per cent, $3.30.
In Tennessee hand-mined lump, $7@$7.25 per long ton for 75 per cent with adjustment of 25c. per unit for variations. Washed rock, $6.50 for 65 per cent per short ton with adjustment of 15c. per unit for variations.
Washed run of mine, 72 per cent, $5.50@$6 per short ton.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Heavy demand for furnace rock with some increase in demand for ground rock for direct application. Requirements of fertilizer manufacturers not very pressing.

Potash—Contract prices, per ton:
Kainit, 14@16 per cent, $7.33.

Pumice Stone—Imported lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
Furnace size, 12c.
Lump, 11½c.
Fines, through ½ in., 11½c.
Cinder from ore to remain property of buyers.
Market very limited and quiet.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
450 mesh, $31.
350 mesh, $25.
200 mesh, $20.
100 mesh, $8.
Market for amorphous silica is good.
Glass sand, $2@$2.50 per ton; brick and molding sand, $2@$2.25.
Demand about 75 per cent normal.

Rutile—F.o.b. Virginia points, per lb.:
Granular, 94@96 per cent TiO_2, 12@15c.
Pulverized, 100 mesh, 94@96 per cent, 17@30c.
93 per cent TiO_2, 10@12c., Florida.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; 18@20 for export, f.a.s. New York.

Talc—Per ton, in 50 lb. paper bags, Vermont mills, carloads:
Ground, 200 mesh, extra white, $10.
Ground, 180 mesh, medium white, $9.50.
Ground, 160 mesh, medium white, $9.
Decided advancing tendency. One producer reports contracts for about 80 per cent of maximum capacity and is operating two nine-hour shifts daily.
Double air-floated, 325 mesh, $14.75 per net ton, New York State.
Demand good.
In California $20@$30 per ton, ground.
In Georgia, powdered, per ton:
White, $12.
Grayish white, $8.
Red, $12.
Yellow, $8.
Roofing, $7.
Market considered good.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:
Once ground:
Rose and cream colored, $16@$25.
White, $18@$27.
Double ground:
Rose and cream, $17@$25.
White, $19@$30.
Air-float:
Rose and cream, $25@$30.
White, $35.
Super air-float:
Rose and cream, $35@$40.
White, $40@$45.
No change in prices, but strengthening is noticeable.

Zircon—Freight allowed east of Mississippi River:
99 per cent, 6c. per lb., f.o.b. Florida.
Powdered, 7c. per lb., f.o.b. Florida.

Mineral Products

Arsenious Oxide (white arsenic)—12@12½c. per lb.

Copper Sulphate—4.75@4.85c. per lb., car lots.

Sodium Nitrate—$2.50 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $41.50 per ton.

Sodium Sulphate—$24@$26 per ton, New York.

Ferro-Alloys

Ferrocerium—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 30c. per lb.; 4 to 6 per cent carbon, 10¾c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $107.50 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $38@$40, f.o.b. furnace; 16@19 per cent, $37@$38.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, $41.50 @$46.50 per gross ton, f.o.b. works; 50 per cent, $75 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—89@91c. per lb. of contained W, f.o.b. works. Quiet.

Ferro-uranium—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium — $3.50@$4 per lb. of V contained, f.o.b. works. Active.

Ferro-alloy markets are generally quiet. Vanadium is active, tungsten fair, molybdenum dull and manganese slow.

Metal Products

Rolled Copper—Sheets, 21¾c.; wire, 16¾c.

Lead Sheets—Full lead sheets, 12.75c. per lb.; cut lead sheets, 12.50c. in quantity, mill lots.

Nickel Silver—27¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 19¼c. per lb.; rods 16¼c. per lb.

Zinc Sheets—9¾c. per lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$45@$47 per net ton, f.o.b. shipping point.

Firebrick—First quality, $42@$45 per M., Ohio and Kentucky works; $42@$45 Central Pennsylvania; second quality, $35@$38.

Magnesite Brick — 9-in. straights, $65@$68 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Price furnished by Foote Mineral Co., Philadelphia.

Silica Brick—$42@$45 per M. Pennsylvania; $50@$53 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

The Iron Trade

Pittsburgh, March 4, 1924

The Pennsylvania Railroad has just distributed orders for 11,000 freight cars, box, automobile and stock, this being apart from 1,000 cars ordered a month ago. The New York Central's distribution of 14,500 cars has been announced in the last week. Total freight cars orderd since Jan. 1 slightly exceed 50,000. The heaviest buying year recently was 1922, averaging slightly over 15,000 cars a month, and the heaviest building year was 1923, with almost 15,900 built a month, while there was a fair backlog of business on books at the beginning of this year.

Steel prices are well held. Plates quotable at 2.40c. rather than at 2.50c., and shading in sheets has increased, making black sheets quotable at 3.75c. to 3.85c. and galvanized sheets at 4.90c. to 5.0c.

Pig Iron—Market extremely dull. Consumption good. Prices are $23.50 for bessemer, $22 for basic, and $23 for foundry, f.o.b. Valley furnaces, with $1.76 freight to Pittsburgh.

Connellsville Coke—Spot furnace coke remains at $4.25. Consumers uncovered for second quarter are holding off, being quoted $4.50. Spot foundry remains at $5@$5.50.

Exports and Imports of Metals, January, 1923 and 1924

Exports of Copper, Lead, and Zinc

In pounds

	January, 1923	January, 1924
Copper		
Ores, concentrates matte, and regulus (copper content)	3,659	
Copper and manufactures of (total)	76,859,283	69,750,583
Refined, in ingots, and bars	64,286,337	64,616,780
Exported to:		
Belgium	3,174,204	4,584,906
France	15,021,273	11,901,166
Germany	21,593,398	5,359,085
Italy	5,974,785	9,058,685
Netherlands	2,825,166	324,733
Spain	1,195,570	142,057
Sweden	1,157,059	1,693,392
United Kingdom	9,410,099	16,278,410
Canada	671,611	3,029,267
China	2,396,800	7,672,000
Japan		2,687,307
Other countries	866,372	1,885,772
Old and scrap	621,928	92,932
Composition metal, copper chief value	1,840	6,048
Pipes and tubes	138,492	168,457
Plates and sheets	228,921	366,701
Wire except insulated	1,171,494	642,460
Lead		
Pigs and bars		
From domestic ore	112,040	1,018,983
From foreign ore	8,184,558	9,455,840
Exported to:		
France	2,240,990	2,568,104
Germany	1,100,226	672,712
Netherlands	918,713	448,129
United Kingdom	3,965,934	2,371,805
Other Europe		4,145,639
Argentina		134,524
Brazil		22,659
Other countries	70,735	111,251
Zinc		
Dross	3,429,305	1,933,623
Spelter		
From domestic ore	22,678,893	3,828,035
From foreign ore	1,337,828	1,848,505
Total zinc slabs and blocks	24,016,721	5,676,540
Exported to:		
Belgium		336,001
France	3,088,319	1,400,270
Germany	1,422,560	314,645
United Kingdom	18,983,081	2,072,430
Canada	215,043	3,573
Other countries	307,718	1,549,621
In sheets and strips	837,595	852,456
Zinc dust	562,995	389,624
Other zinc manufactures	196,811	64,347

Imports of Ores and Metals

In Pounds Unless Otherwise Stated

	January, 1923	January, 1924
Antimony		
Ore	264,703	164,720
Metal, matte, and regulus	450,240	629,954
Copper		
Ore	2,545,083	8,598,414
Concentrates	5,136,981	1,279,633
Regulus, coarse metal and cement copper	55,474	290,019
Imported from:		
Spain	310,298	1,111,103
Canada	235,328	94,167
Mexico	3,923,675	1,271,400
Cuba	1,821,571	
Chile	1,064,841	6,755,405
Colombia	55,474	74,821
Peru	102,861	253,127
Other countries	223,490	608,043
Unrefined black, blister and converter copper in pigs and bars	21,262,380	41,962,680
Imported from		
Spain	2,386,112	1,908,771
United Kingdom	35,821	714
Canada	643,261	1,555,188
Mexico	6,078,528	7,229,476
Chile	823,275	1,664,624
Peru	271,675	7,538,508
Portuguese Africa	9,382,749	20,525,910
Other countries	1,640,959	1,539,489
Refined copper	8,500,338	16,776,131
Old and clippings for remanufacture	406,944	112,307
Composition metal, copper chief value	89,298	50,000
Copper manufactures	10,503	3,027
Brass		
Old and clippings for remanufacture	2,391,176	1,094,887
Manufactures of brass	26,481	54,168
Lead		
Ore and matte	647,344	10,455,463
Bullion or base bullion	25,919,542	15,619,397
Pigs, bars, other forms and old	1,481,931	180,643
Manufactures of lead (except type metal)	10,101	12,962
Manganese ore, long tons	10	19,981
Pyrites, long tons	29,582	40,843
Tin		
Tin ore, tons	800	1
Tin in bars, blocks, and pigs	13,221,354	12,925,083
Imported from:		
United Kingdom		3,293,856
British Straits Settlements	8,211,123	8,329,544
China	840,189	
Dutch East Indies	1,918,902	118,320
Hongkong	2,010,562	241,075
Australia		123,200
Other countries	240,578	819,088
Zinc ore (dutiable)		664,572
Zinc in blocks and pigs (dutiable)	1,500	17,007
Zinc dust (dutiable)	183	1,457

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1923	1924	1923	1924	1923	1924
January	65.668	63.447	31.928	33.549	465.053	425.524
February	64.313	64.359	30.875	33.565	468.631	430.457
March	67.556	.....	32.310	.....	469.269	.....
April	66.855	.....	32.346	.....	465.220	.....
May	67.043	.....	32.611	.....	462.252	.....
June	64.861	.....	31.611	.....	461.132	.....
July	63.015	.....	30.942	.....	458.025	.....
August	62.793	.....	30.952	.....	455.714	.....
September	64.203	.....	31.698	.....	453.901	.....
October	63.649	.....	31.718	.....	452.024	.....
November	63.818	.....	32.774	.....	437.839	.....
December	64.705	.....	33.375	.....	435.500	.....
Year	64.873	.....	31.929	.....	457.047	.....

New York quotations, cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1923	1924	1923	1924	1923	1924
January	14.510	12.401	64.494	61.273	71.409	67.193
February	15.355	12.708	67.700	63.113	74.500	68.167
March	16.832	.....	73.851	.....	81.464	.....
April	16.663	.....	73.169	.....	81.331	.....
May	15.440	.....	67.460	.....	76.568	.....
June	14.663	.....	66.607	.....	73.238	.....
July	14.321	.....	65.278	.....	72.364	.....
August	13.822	.....	64.034	.....	70.000	.....
September	13.323	.....	63.194	.....	68.275	.....
October	12.574	.....	60.614	.....	64.250	.....
November	12.727	.....	61.648	.....	66.477	.....
December	12.823	.....	62.035	.....	67.611	.....
Year	14.421	.....	65.840	.....	72.291	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1923	1924	1923	1924	1923	1924
January	7.633	7.972	7.571	8.002	27.119	31.528
February	8.050	8.554	8.093	8.643	28.519	34.589
March	8.252	.....	8.254	.....	28.815	.....
April	8.101	.....	7.996	.....	26.956	.....
May	7.306	.....	7.085	.....	25.614	.....
June	7.146	.....	6.852	.....	25.429	.....
July	6.237	.....	6.126	.....	24.188	.....
August	6.582	.....	6.496	.....	24.222	.....
September	6.856	.....	6.700	.....	25.688	.....
October	6.831	.....	6.570	.....	27.815	.....
November	6.846	.....	6.582	.....	30.352	.....
December	7.369	.....	7.369	.....	31.042	.....
	7.267	.....	7.141	.....	27.147	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1923	1924	1923	1924	1923	1924
January	37.986	48.250	39.173	48.750	181.852	246.790
February	40.693	52.772	42.011	53.272	190.513	272.399
March	46.569	.....	48.569	.....	219.607	.....
April	44.280	.....	45.810	.....	213.081	.....
May	42.346	.....	43.135	.....	203.097	.....
June	40.375	.....	40.957	.....	191.798	.....
July	37.970	.....	38.490	.....	181.188	.....
August	38.841	.....	39.269	.....	186.705	.....
September	41.047	.....	41.547	.....	198.263	.....
October	41.322	.....	41.851	.....	203.957	.....
November	43.495	.....	43.995	.....	220.710	.....
December	46.662	.....	47.160	.....	235.007	.....
Year	41.799	.....	42.664	.....	202.148	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1923	1924	1923	1924
January	6.815	6.426	35.733	34.761
February	7.152	6.756	35.613	36.518
March	7.706	.....	36.720	.....
April	7.197	.....	34.275	.....
May	6.625	.....	31.057	.....
June	6.031	.....	29.548	.....
July	6.089	.....	29.335	.....
August	6.325	.....	32.386	.....
September	6.438	.....	33.469	.....
October	6.293	.....	32.995	.....
November	6.347	.....	32.949	.....
December	6.260	.....	32.611	.....
Year	6.607	.....	33.058	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)		
	New York		New York		Refined New York		Crude
	1923	1924	1923	1924	1923	1924	1924
January	6.884	10.279	72.731	59.500	112.462	122.115	115.500
February	7.290	10.935	70.636	59.565	113.273	124.739	115.935
March	8.885	.....	70.808	.....	110.846	.....	.....
April	8.380	.....	69.200	.....	116.840	.....	.....
May	7.477	.....	68.000	.....	115.007	.....	.....
June	6.839	.....	67.769	.....	115.615	.....	.....
July	7.097	.....	66.980	.....	116.000	.....	.....
August	7.753	.....	65.212	.....	116.000	.....	.....
September	7.633	.....	63.000	.....	116.000	.....	.....
October	8.005	.....	61.769	.....	116.923	.....	.....
November	9.156	.....	61.917	.....	124.479	.....	.....
December	9.365	.....	60.000	.....	125.000	.....	.....
Year	7.897	.....	66.502	.....	116.537	.....	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1923	1924	1923	1924	1923	1924
January	29.27	24.76	27.35	23.76	28.77	23.88
February	29.79	25.26	28.15	23.76	27.21	25.06
March	32.03	.....	31.79	.....	31.77	.....
April	32.77	.....	32.77	.....	32.77	.....
May	31.87	.....	29.83	.....	32.46	.....
June	30.27	.....	28.34	.....	29.81	.....
July	28.47	.....	26.52	.....	27.47	.....
August	28.27	.....	26.77	.....	26.77	.....
September	28.26	.....	26.26	.....	26.72	.....
October	26.96	.....	25.01	.....	25.52	.....
November	24.79	.....	22.57	.....	23.60	.....
December	24.54	.....	22.62	.....	23.72	.....
Year	28.94	.....	27.33	.....	28.05	.....

In dollars per long ton.

Monthly Crude Copper Production

Domestic

	1923			1924
	October	November	December	January
Alaska shipments	8,819,469	8,651,360	6,706,322	5,753,719
Calumet & Arizona	3,226,000	3,688,000	3,876,000	3,764,000
Miami	5,590,000	5,883,000	5,667,345	5,884,000
New Cornelia	3,436,861	3,059,377	3,221,044	3,221,044
Old Dominion	2,314,000	2,315,000	2,156,000	2,344,000
Phelps Dodge	13,608,000	12,592,000	11,114,000	9,818,000
United Verde Extension	3,320,514	3,242,970	4,189,856	3,517,862
Others, estimated (c)	16,000,000	17,000,000	13,750,000	12,500,000
Imports: Ore and concentrates, matte	14,738,881	12,682,229	13,883,925	10,168,066
Partly from				
Chile	8,441,900	1,287,744	4,486,649	6,755,405
Cuba	.....	5,074,688	3,332,723	.....
Canada	2,411,109	1,994,624	32,433	94,167
Mexico	2,245,866	1,658,862	1,721,619	1,271,400
Imports of black and blister, unrefined	36,810,274	44,438,675	18,802,829	41,962,680
Partly from				
Chile	14,221,061	9,855,661	569,913	1,664,624
Peru	9,785,013	12,011,652	405,705	7,538,508
Africa	.....	12,017,927	6,364,020	20,525,910
Mexico	7,808,376	6,781,211	4,430,127	7,229,476
Imports of refined and old	10,493,274	3,207,054	20,547,641	16,941,465

Foreign

Boleo, Mexico	1,248,030	1,454,198	1,378,125	1,486,721
Falcon Mines, Rhodesia	500,600	(a)	508,000	(a)
Furukawa, Japan	3,246,061	2,649,288	2,794,476	(a)
Granby Cons., Canada	2,606,372	2,692,616	2,889,014	3,268,463
Katanga, Africa	11,428,513	10,460,520	10,969,875	11,299,900
Mount Morgan, Aust	680,000	(a)	1,158,000	(a)
Mount Lyell, Aust	844,000	1,524,000	882,000	(a)
Phelps Dodge Mexican	3,331,000	2,373,000	4,048,000	3,395,000
Sumitomo, Japan	(a)	2,956,912	2,829,043	2,713,584
Wallaroo & Moonta, Aust	549,475	584,599	(a)	(a)

Comparative Monthly Copper Production

	1920	1921	1922	1923
January	121,903,744	90,596,597	32,015,292 (b)	112,267,000
February	117,540,000	86,682,941	45,957,536 (b)	102,725,000
March	120,309,316	91,046,345	55,705,760 (b)	121,562,000
April	116,078,871	46,946,523 (b)	76,601,000 (b)	118,157,000
May	114,964,207	25,310,511 (b)	88,714,000 (b)	125,438,000
June	116,107,856	24,623,693 (b)	93,740,000 (b)	125,479,000
July	109,729,610	22,033,739 (b)	91,000,000 (b)	125,249,000
August	112,460,254	23,248,398 (b)	101,188,000 (b)	131,088,000
September	104,919,562	23,855,316 (b)	96,408,000 (b)	124,523,000
October	105,231,571	23,231,572 (b)	103,273,000 (b)	132,481,000
November	106,700,178	28,341,442 (b)	102,845,000 (b)	127,963,000
December	95,709,009	26,629,137 (b)	103,003,000 (b)	128,193,000

(a) Not available. (b) Department of Commerce. (c) Chiefly A. S. & R. Co.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Steel structurals $2.50 per 100 lb., Pittsburgh, with exceptional tonnages reported at $2.40. Lumber production and shipments slower despite increasing demand. Pine stocks low owing to heavy rains; price trend has been steadily upward since Jan. 1, with exception of short leaf timbers, special cuttings and railroad stock. General tendency of cement prices upward. Manila rope quotations higher throughout country. Explosives market shows little change. Downward trend in flotation oils. Trend of steam and water hose prices upward during last two months.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$3.00	$4.10	$4.00	$5.00	$4.34
Black					
No. 28	3.85	4.75	4.85	5.80	4.85
Galvanized					
No. 28	5.00	5.75	5.85	6.50	5.85

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	.....	$43.00
Standard openhearth rails	43.00	43.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$3.05@3.15	$2.90	$3.00	$3.85	$4.70	$3.72
Track bolts	4.00@4.25	3.85@4.50	4.00	4.90	5.95	4.57
Standard section angle bars	2.75	2.75	2.75	3.45	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.50	$3.00	$3.64	$4.40	$3.45	$3.30	$3.60
Channel, 3 to 15 in.	2.50	3.00	3.64	4.40	3.45	3.30	3.60
Angles, 3 to 6 in., ¼ in. thick	2.50	3.00	3.64	4.40	3.45	3.30	3.60
Tees, 3 in. and larger	2.50	3.00	3.64	4.40	3.45	3.30	3.60
Plates	2.50	3.00	3.64	4.40	3.45	3.30	3.60

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	20%
Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%

	New York	Cleveland	Chicago
Drill Rod (from list)	55%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	1 to 3	62	50½	⅛ to 1¼	30	13
LAP WELD	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	44%	47%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$61.60@63.60	$56.50	$49.00	$57.20@60.20	$54.60	$60.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$1.00	$3.50	$3.50
Cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1179	$0.1230	$0.064	$0.125	$0.08	$0.108	.....
6x12x12	.1769	.1844	.088	...	.11	.156	.....
8x12x12	.2211	.2305	.12	.215	.145	.244	$0.1968

MACHINE BOLTS—	New York	Cleveland	Chicago
1½ and 1¼x3 in. up to 12 in.	15 %	50—5%	50%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$35.00	$36.00	$37.00	$40.00
3x6 and 8	35.00	36.00	37.00	40.00
4x4-6 and 8	35.00	36.00	37.00	40.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$51.00	$52.00	$42.00	$44.00
3x10 to 10x10	57.00	58.00	47.00	50.00
3x12 to 12x12	60.00	61.00	55.00	57.00

Other Cities	8 x8-In. x 20 Ft. and Under Pine	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir
Boston	$58.00	$68.00	$52.00	$52.00	$75.00	$90.00
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver	.....	40.75	40.75	40.75	.....	41.75
Minneapolis	44.00	43.75	40.00	.....	47.00	44.75
Kansas City	45.75	48.50	.....	.....	58.75	49.50
Birmingham	30@35	.....	.....	.....	40@45	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.00	$3.80	$4.25	$4.55	$3.36	$4.95
Cut	3.15@3.25	4.45	5.25	5.75	3.59	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.60	$2.50@2.60	$2.60@2.70
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.41	2.41	2.46

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Common	Lump, per Barrel Finishing	280-lb.net Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.00	.....	....	(180-lb net) 2.10

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.97	$1.01	$0.94	$1.07

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.00	14.25	16.50	15.75
White	15.00	14.25	15.00	14.25

HOSE—

Fire: 50-Ft. Lengths
Underwriters' 2½-in. coupled ..... 56c per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.33 4 ply $0.40½

Steam—Discounts from List
First grade ..... 30–10% Second grade ... 40–5% Third grade .. 40–10%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:
Competition ..... 50–10% Best grade 50–5%

LEATHER BELTING—List price, 2c. per sq. in. per ply.

Grade	Discount from list
Medium	40–2½%
Heavy	30–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$0.22½	New Orleans	$0.17½
New York	.19½	Seattle	.18
Chicago	.18	San Francisco	.17

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.2125	.2325
New Orleans	.195	.22
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.62
Pine oil, pure, dest. dist. f.o.b. New York	.55
Pine tar oil, ref. f.o.b. New York	.35
Pine tar oil, crude, tank cars f.o.b. Jacksonville, Fla.	.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09
Litharge, delivered New York, casks, 500 lb. lots, per 100 lb.	11.25
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Company Reports

Chino Copper Co.

A report of the operations of the Chino Copper Co. for the fourth quarter of the fiscal and calendar year 1923 states that the total amount of ore treated for the quarter was 631,400 dry tons, an average of 6,863 tons per day, the average grade being 1.60 per cent copper. The comparative figures for the preceding quarter were 8,017 tons per day, containing an average of 1.48 per cent copper. The average gross recovery of copper contained in the concentrates was 24.05 lb. per ton of ore treated, compared with 18.46 lb. for the previous quarter. In addition to the copper produced from mill operations, there were 2,556 tons of crude ore shipped direct to the smelter, containing an average of 2.17 per cent copper.

The comparative net production of refined copper from all sources in pounds follows:

Fourth Quarter 1923		Third Quarter 1923	
October	5,275,428	July	5,716,379
November	4,759,639	August	4,202,636
December	4,695,685	September	3,838,675
Total	14,730,752	Total	13,757,690

The cost per pound of copper produced from all sources was 12.59c., compared with 14.88c. for the quarter ended Sept. 30, 1923. These costs include depreciation and all operating and general charges, and also credit for gold and silver values and miscellaneous revenues.

The following tabulation shows the financial results of operations:

	Fourth Quarter 1923	Third Quarter 1923
Operating gain	$128,673.44	$44,551.60
Miscellaneous revenue, including precious metals	52,736.33	81,546.16
Operating gain for quarter	$181,409.77	$126,097.76
Plant depreciation	172,961.08	120,000.00
Balance to surplus	$8,448.69	$6,097.76

The above figures are based on an average price of 12.65c. per lb. for copper, compared with 14.92c. for the quarter ended Sept. 30, 1923.

Installation of new concentrating equipment progressed satisfactorily during the quarter, resulting in greatly improved recoveries and unit costs. This work will continue as rapidly as possible until the entire concentrator is remodeled, when continued improvement in metallurgy and costs may be expected.

St. Joseph Lead Co.

A report of operations of St. Joseph Lead Co. for 1923 states that dividends to the amount of $3,098,752.50 in cash have been paid to stockholders, and to minority stockholders in subsidiary companies $164,316. The earnings for the year, after deducting all charges for depreciation, depletion and reserve for Federal taxes, resulting from the operation for the fiscal year, were $4,379,854.07.

The company mines produced 2,778,347 tons of ore; the mills 154,283 tons of concentrates. Smelter production was 95,511 tons of pig lead. The sales of pig lead for the year amounted to 95,964 tons. (This does not include sales of lead purchased from the Bunker Hill & Sullivan Mining & Concentrating Co.)

The company, on Oct. 23, 1923, purchased all mines, ore reserves, surface lands and mining plant owned in Southeast Missouri by the Federal Lead Co., a subsidiary of the A. S. & R. Co. These mines are adjacent to the mines owned by the company and at many points underground connections have already been made. This purchase, besides increasing the immediate output, will make available much ore which could not have been profitably mined by either company, thus tending not only to increase the life of the company but of the whole district.

The purchase was financed by the payment of $4,688,510.80 in cash and $5,000,000 in notes of $1,000,000, each due in one, two, three, four and five years with interest at the rate of 6 per cent per annum for the property and plant and of $419,798.73 for the inventory, including fuel and carbons for diamond drilling.

The extensive drilling campaign in the Tri-State district was continued with most satisfactory results. In order to handle more efficiently this branch of the company's business, a subsidiary corporation was formed, known as Kansas Explorations, Inc., with a capital stock of $1,000,000.

The balance sheet of Kansas Explorations, Inc., is included in the consolidated balance sheet of the St. Joseph Lead Co. and subsidiary companies. The money owed by the Kansas Explorations, Inc., is owed to the St. Joseph Lead Co. The first mill was completed and the first ore milled on Dec. 28, 1923.

Consolidated balance sheet as of Dec. 31, 1923, is as follows:

Assets

Capital Assets:			
Ore reserves and mineral rights	$29,665,192.64		
Less reserve for depletion	11,137,441.06	$18,527,751.58	
Buildings and equipment	$12,353,297.54		
Less reserve for depreciation	1,800,771.53	10,552,526.01	
Real estate		140,109.36	
Farm lands, buildings and equipment	$561,477.96		
Less reserve for depreciation	32,952.29	528,525.67	
Railroad property and equipment	$4,457,672.39		
Less reserve for depreciation	622,238.64	3,835,433.75	$33,584,346.37
Investments:			
Missouri-Illinois Railroad Co.		$362,536.63	
Other		12,000.00	374,536.63
Sinking fund and reserve fund assets—cash and accrued interest			16,608.30
Current assets:			
Cash		$1,304,064.90	
Cash in transit		95,037.15	
Marketable securities		1,449,423.19	
Accounts and notes receivable		1,619,769.95	
Lead on hand and in process		571,512.79	
Materials and supplies		1,715,849.11	
Store accounts (net)		46,591.44	6,802,248.53
Deferred debit items			445,707.54
Total			$41,223,447.37

Liabilities

Capital stock, St. Joseph Lead Co.:			
Authorized—2,000,000 shares of $10.00 each; 1,605,744.6 shares issued		$16,057,446.00	
Less held in treasury, 56,332 shares		563,320.00	$15,494,126.00
Subsidiary companies—minority stock held by the public			235,950.00
Funded debt:			
Mississippi River & Boone Terre Ry. bonds		$2,500,000.00	
Less:			
Held in sinking fund	$695,000.00		
Held in treasury	1,035,000.00	1,730,000.00	770,000.00
Purchase money notes—$1,000,000.00 payable Oct. 23, 1925, 1926, 1927 and 1928			5,000,000.00
Current liabilities			2,366,977.53
Deferred credit items			121,598.68
Reserves, contingencies			1,687,462.97
Surplus:			
Balance, March 1, 1913		$3,925,000.00	
Less amortization distributions		3,523,665.00	
		$401,335.00	
Undistributed profits and increase due to revaluation		13,229,263.62	
Balance, Jan. 1, 1923		$13,630,598.62	
(a) Excess of par value over book value of securities of subsidiary companies acquired during the year		799,949.00	
Net income for year after depreciation	$6,384,827.41		
Add:			
Transportation act	$250,539.51		
Miscellaneous	18,951.38	269,490.89	
Total		$6,654,318.30	
Less:			
Depletion	$1,537,323.71		
Federal taxes	689,470.00		
Miscellaneous charges	47,670.52	2,274,464.23	
Profit and loss surplus		4,379,854.07	
Total		$18,810,401.69	
Less:			
Dividends declared and paid in 1923	$2,488,381.00		
Dividend payable March 20, 1924	774,688.50	3,263,069.50	15,547,332.19
Total			$41,223,447.37

(a) From acquiring capital stock of Kansas Explorations, Inc. $799,949.00

MINING STOCKS

Week Ended March 1, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*40		
Anaconda	New York	39⅞	32⅝	33⅛	De.15, Ja.21, Q	0.75
Aracadian Consol.	Boston	2	1⅝	1⅝		
Ariz. Com'l.	Boston	9	8½	8½	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb	1	1	1		
Calumet & Arizona	Boston	45⅜	43	44	Mc.7, Mc.24, Q	0.50
Cal. & Hecla (New)	Boston	16⅜	15½	16⅜	De. 1, De. 17	0.50
Canario Copper	N. Y. Curb	2⅜	2⅛	2⅜		
Cerro de Pasco	New York	47	45⅜	46½	Ja. 17, Feb. 1	1.00
Chile Copper	New York	28⅛	26½	27⅜	Mh.1 Mh.20, Q	0.62½
Chino	New York	18⅜	17½	17¼	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	3 3/16	2 7/16	3		
Copper Range	Boston	24	22	23½	May '23, Q	1.00
Crystal Copper	Boston Curb	84	75	80		
Davis-Daly	Boston	4 7/16	3 7/16	4¼	Mar. '20, Q	0.25
East Butte	Boston	4½	4¼	4¼	Dec. '19, A	0.50
First National	Boston Curb	25	25	25	Feb. '19, SA	0.15
Franklin	Boston	*90	*80	*82		
Gadsden Copper	Boston Curb	*50	*35	*40		
Granby Consol.	New York	16	14½	15½	May '19, Q	1.25
Greene-Cananea	New York	14½	14	14½	Nov. '20, Q	0.50
Hancock	Boston	1⅛	1	1⅛		
Howe Sound	N. Y. Curb	3	2⅞	3	Ja.2, Ja.15	0.05
Inspiration Consol.	New York	25⅛	22⅜	24⅜	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	3	3	3	May 23, K	0.15
Isle Royale	Boston	15½	15	15½	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1 7/16	1½	1½		
Kennecott	New York	37¼	34⅜	36⅞	Mc.7, Ap. 1, Q	0.75
Keweenaw	Boston	*75	*72	*75		
Lake Copper	Boston	1½	1½	1½		
Magma Copper	New York	32⅜	30⅜	31½	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅝	1½	1⅝		
Mass Consolidated	Boston			*90	Nov. '17, Q	1.00
Miami Copper	New York	22⅜	21⅞	22¼	Fe. 1, Fe. 13, Q	0.50
Michigan	Boston			*50		
Mohawk	Boston	*33	*30½	*33	Se. 22, Oc. 13,	1.00
Mother Lode Con.	New York	8⅛	7⅞	8⅛	De.14, De.31	0.50
Nevada Consol.	New York	13½	12⅝	13⅛	Sept. '20, Q	0.25
New Cornelia	Boston	*18½	*16½	*17½	Au.3, Au.20, Q	0.25
New Dominion	N. Y. Curb	2⅜	2⅛	2⅜		
North Butte	Boston	3	2⅞	2⅞	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*75	*68	*73		
Old Dominion	Boston	*17	*17	*17	Dec. '18, Q	1.00
Osceola	Boston			31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†135	†130		De.20, Ja.2 Q	1.00
Quincy	Boston	20⅜	19½	20⅜	Mar. '20, Q	1.00
Ray Consolidated	New York	11⅞	10½	10⅝	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	*17	*16	*17		
St. Mary's Min. Ld.	Boston	*33	*31	*32½	No.9, De.11, K	1.00
Seneca Copper	New York	5⅜	4	5		
Shannon	Boston	⅜	¼	⅜	Nov. '17, Q	0.25
Shattuck Arizona	New York	6	5⅞	5⅞	Jan. '20, Q	0.25
South Lake	Boston			¼		
Superior & Boston	Boston	*90	*85	*90		
Tenn. C. & C. cfs.	New York	9	8⅜	8⅜	De.31, Ja.15, Q	0.25
Tuolumne	Boston			*42	May '13,	0.10
United Verde Ex.	N. Y. Curb	25	23¾	25	Ja.1, Fe. 1, Q	1.00
Utah Consol.	Boston			*1	Sept. '18,	0.25
Utah Copper	New York	66⅜	64	65⅞	De.3, De.15, Q	1.00
Utah Metal & T.	Boston	*30	*30	*30	Dec. '17,	0.30
Victoria	Boston	*65	*65	*65		
Walker Mining	N. Y. Curb	3	2⅞	3		
Winona	Boston	*25	*20	*25		
Wolverine	Boston			5¾		
NICKEL-COPPER						
Internat. Nickel	New York	13	12½	12⅞	Mar. '19,	0.50
Internat. Nickel pfd.	New York	80	79	80	Ja.17, Fe.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	3⅜	2¼	3¼		
National Lead	New York	140	138	140	Mh.14, Mh.31, Q	2.00
National Lead pfd.	New York	115	115	115	No. 23, De. 15	1.75
St. Joseph Lead	New York	26½	25¾	26	De.9, De.20	0.50
ZINC						
Am. Z. L. & S.	New York	9⅞	8	8⅛	May '20	1.00
Am. Z. L. & S. pfd.	New York	33⅝	31⅜	32⅛	Nov. '20, Q	1.50
Butte C. & Z.	New York	5⅝	5⅛	5⅛	Ma. '23,	0.50
Butte & Superior	New York	19	16	17⅛	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	5¼	4⅞	5	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb			149	Ja.31, Fe.9	2.00
United Zinc	N. Y. Curb			*25		
Yellow Pine	Los Angeles	*80	*80	*80	Dec. '23	0.03
SILVER						
Alvarado	N. Y. Curb			1¼		
Batopilas Mining	New York	⅜	⅛	⅛	Dec. '07, I	0.12
Beaver Consol.	Toronto	*26½	*25½	*25½	May '20, K	0.03
Castle-Trethewey	Toronto	*68	*64	*67		
Coniagas	Toronto	2.30	2.30	2.30	Oc.19, No.1, '23	0.02½
Crown Reserve	Toronto	*66	*64	*64	Jan. 17,	0.05
Kerr Lake	N. Y. Curb	1⅞	1⅞	1⅞	Oc. 1, Oc. 15, Q	0.12½
La Rose	Toronto	†*22	†*22	*23	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*16	*15½	*15	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.57	3.45	3.50	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6¼	6	6¼	Ja.1, Ja.21, QX	0.30
Ontario Silver	New York	6⅝	6⅜	6⅝	Jan. '19, Q	0.50
Temiskaming	Toronto	*31	*31	*31	Jan. '20, K	0.40

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	¾	¾	¾		
Alaska Juneau	New York	1	¾	1		
Carson Hill	Boston	2	1⅞	1⅞		
Cresson Consol. G	N. Y. Curb	4	3¾	3¾	De.31, Ja.10, Q	0.10
Dome Mines	New York	17¾	17½	17⅝	Mc.26, Ap.21, Q	0.50
Golden Cycle	Colo. Springs	1.28	1.28	1.28	De. '22, Q	0.02
Hollinger Consol.	Toronto	11.70	11.55	11.60	Mc.6, Mc.24, M	0.05
Homestake Mining	New York	51	50½	50⅝	Fe.20, Fe.25, M	0.50
Kirkland Lake	Toronto	*20	*18⅜	*18½		
Lake Shore	Toronto	†3.60	†3.58	3.61	Fe.2, Fe.24, Q	0.02
McIntyre-Porcupine	New York	16⅞	16⅜	16½	De. 1, Ja. 2,	0.25
Portland	Colo. Springs	*48	*45	*48	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 5/16	1¼	1¼		
Tom Reed	Los Angeles	*51	*49	*49	Dec. '19,	0.02
United Eastern	N. Y. Curb	*95	*89	*89	Ja.8, Ja.28, Q	0.15
Vipond Cons.	Toronto	1.27	1.25	1.25		
Wright-Hargreaves	Toronto	3.00	2.90	2.95	Mc.15, Ap. 1, Q	0.02½
Yukon Gold	N. Y. Curb	*70	*65	*65	June '18,	0.02
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb			*17		
Con. Cortez	N. Y. Curb	*67	*65	*65		
Con. Virginia	San Francisco	*6½	*6½	*6½		
Continental Mines	N. Y. Curb	3½	3½	3½		
Dolores Esperanza	N. Y. Curb	*55	*55	*55	Jy. 1, Jy. 10 Q	0.05
Jib Consol.	N. Y. Curb	*29	*25	*29		
Premier Gold	N. Y. Curb	2	2	2		
Tonopah Belmont	N. Y. Curb	*70	*66	*70	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*37	*37	*37	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	1 1⅛	1 1/16	1 1⅛	Mc. 11, Ap. 1	0.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1⅛	Se.30, Oc. 1	0.07½
Unity Gold	N. Y. Curb	2 1/16	1⅞	1⅞		
West End Consol.	N. Y. Curb			*74	Mar. '23, Q	0.05
SILVER-LEAD						
Ahumada	Boston Curb	6	6	6	Mc., Ap. 2,	0.07½
Bingham Mines	Boston	16¾	16¼	16¼	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake			*85	Dec. '20,	0.15
Chief Consol.	Boston Curb	4	4	4	Ja 11, Fe.1, Q	0.10
Columbus Rexall	Salt Lake	*28	*27½	*27½	Aug. '22	0.03
Consol. M. & S.	Montreal	37⅛	35½	35½	Oct. '20, Q	0.62½
Daly Mining	Salt Lake			1.77½	July '20	0.10
Erupcion	Boston Curb			2¼	Mc. 15, Ap.2,	0.07½
Federal M. & S.	New York			11½	Jan., '09	1.50
Federal M. & S. pfd.	New York	44½	43¼	44¼	Fe.26, Mh.15, Q.	1.75
Florence Silver	Spokane	*20	*20	*20	Apr. '19, QX	0.01
Hecla Mining	N. Y. Curb	9¼	9	9¼	Fe.15, Mh.15Q	0.25
Indian Mines	N. Y. Curb			*64		
Iron Blossom Con.	N. Y. Curb			*31	Oct. 26, '23,	0.02
Marsh Mines	N. Y. Curb	*11	*10	*10	June '21, I	0.02½
Park City	Salt Lake			4.75	Jan. 24,	0.15
Park Utah	N. Y. Curb			4½	De.8, Ja.2, Q	0.15
Prince Consol.	Salt Lake			*75	Nov. '17,	0.02
Silversmith	Spokane	*34	*30	*32	Oc. 1, Oc. 10	0.01
Simon Silver-Lead	N. Y. Curb			*1		
Tamarack-Custer	Spokane	1.35	1.35	1.35	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.20	4.02½	4.20	Ja. 5, X	0.25
Utah-Apex	Boston	2⅞	2½	2⅝	June '23, QX	0.50
IRON						
Bethlehem Steel	New York	58⅛	56⅛	57	Mh. 1, Ap. 1, Q	1.25
Char. Iron	Detroit			1¼		
Char. Iron pfd.	Detroit			2		
Colorado Fuel & Iron	New York	27	26	26½	Fe.11, Fe.25 Q	2.00
Col. Fuel & Iron pfd.	New York			102	Fe.11, Fe.25, Q	2.00
Gt. North'n Iron Ore	New York	29	28½	28⅜	De.10, De.27	2.00
Inland Steel	N. Y. Curb			46	Mh.15, Apl. 1 Q	0.62½
Mesabi Iron	N. Y. Curb	6⅜	6⅛	6⅜		
Replogle Steel	New York	11	10½	10⅝		
Republic I. & S.	New York	57½	55¼	56⅜	May '21	1.50
Republic I. & S. pfd.	New York	94⅞	94	94⅛	Mh.20, Ap.10 QX	2.75
Sloss-Sheffield S. & I.	New York	65⅝	62½	63½	Mc.10, Mc.20	1.50
Sloss-Shef. S. & I. pfd.	New York			84	De.20, Ja.2, Q	1.75
U. S. Steel	New York	104⅞	101⅜	103⅞	Mc. 29, QX	1.75
U. S. Steel pfd.	New York	119½	119	119½	Mc. 29, Q	1.75
Virginia I. C. & C.	New York			49	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York			80	De.15, Ja.22	2.50
VANADIUM						
Vanadium Corp.	New York	31	29½	30⅜	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	30½	30⅛	30⅛	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	58	58	58	Se.29, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	10⅜	9⅞	9⅞	Nov '19, Q	1.00
Texas Gulf	New York	63⅜	62⅞	63⅛	Mh.3, Mh.15 QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4	3⅞	3⅞		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	43	42⅛	42⅜	Fe.18, Mh.1, Q	0.75
Amer. Metal pfd.	New York	112	112	112	Fe.20, Mh.1, Q	1.75
Amer. Sm. & Ref.	New York	62	58⅜	60½	Ja. 11, Fe. 1, Q	1.25
Amer. Sm. & Ref. pfd.	New York	99	98½	98⅛	Fe.20, Mh.1,	1.75
U. S. Sm. R. & M.	New York	22½	20⅜	21	Jan. '21, Q	0.50
U.S. Sm. R. & M. pfd.	New York	40⅜	40⅛	40⅛	Ja.7, Ja.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial, X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.